October 28, 1957 75 Cents

AVIATION WEEK

A McGRAW-HILL PUBLICATION

NATO Finishes Fighter Trials

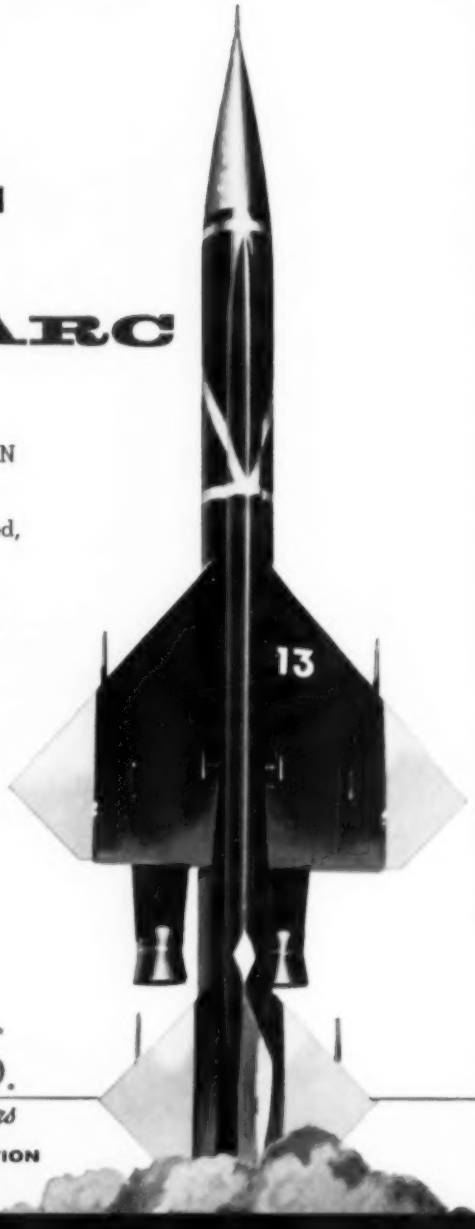
•

Tracking Camera Follows ICBM

Missile Tracker's Moon Photograph

from Foote Bros.—

a guiding hand on the BOMARC



And now—the Boeing Bomarc IM-99—NEWEST WEAPON FOR AMERICA'S DEFENSE.

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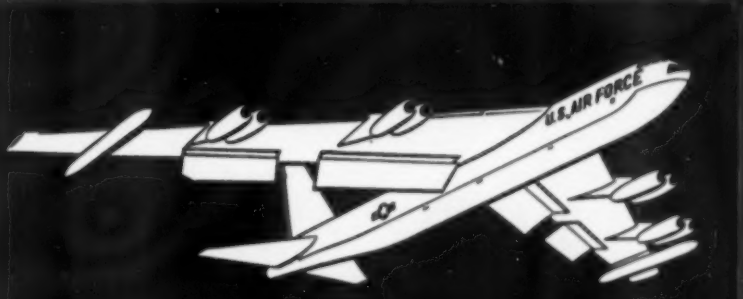

The B-52 jet bomber employs Goodyear fuselage cells—the largest fuel cells being built into U. S. jets today—fabricated to fit contour cut-outs and sump areas—delivered in quantity from both our Akron and Los Angeles facilities. Goodyear delivers water cells for the aircraft as well.

The 707-320, Boeing's long-range intercontinental jet, packs some of its big reach in contouring tanks—also built by Goodyear.

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AVIATION CALENDAR

Oct. 28—Sixth Aviation Conference, Worcester Municipal Airport, Mass.

Oct. 28-29—Third Annual Meeting, Association of the U. S. Army, Sheraton-Park Hotel, Washington, D. C.

Oct. 28-29—First National Conference on Applied Meteorology, Hotel Statler, Hartford, Conn.

Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

Oct. 28-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel, New York.

Oct. 28-31—National Industrial Packaging & Handling Exposition, Atlantic City Convention Hall, N. J.

Oct. 30-Nov. 1—Annual Meeting, Air Traffic Control Assn., CAA Technical Development Center, Indianapolis, Ind.

Oct. 30—Aviation Electrical Equipment Display, U. S. Grant Hotel, San Diego.

Oct. 31-Nov. 1—Third Annual Electron Devices Meeting, The Institute of Radio Engineers, Shoreham Hotel, Washington, D. C.

Oct. 31-Nov. 1—Fourth Annual Meeting, Professional Group on Nuclear Science, Henry Hudson Hotel, New York.

Nov. 1-3—Dallas Air Fair, sponsored by the Dallas Junior Chamber of Commerce, Addison Airport, Dallas, Tex.

Nov. 2-8—Second World Metallurgical Congress & 39th National Metal Exposition & Congress, Palmer House, Hotel Sherman and International Amphitheater, Chicago.

Nov. 4-8—Fourth Institute on Electronics in Management (automatic data processing system), The American University, 1901 F St., Washington 6, D. C.

Nov. 5-7—Joint Military-Industry Guided Missile, Reliability Symposium (limited to those with Secret security clearance), Naval Air Missile Test Center, Pt. Mugu, Calif.

(Continued on page 6)

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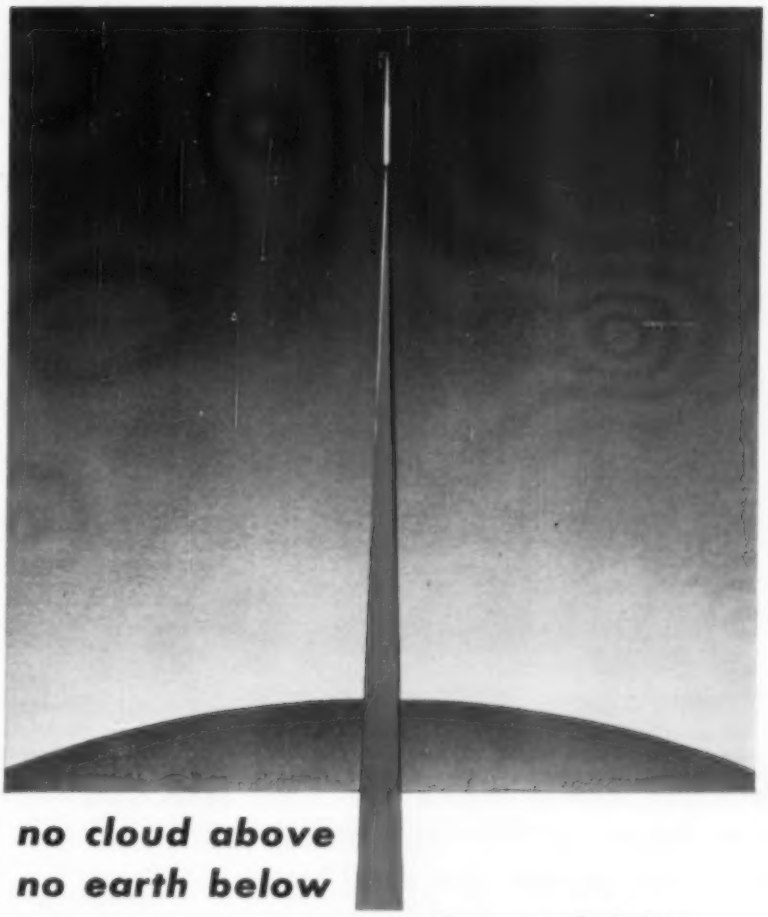

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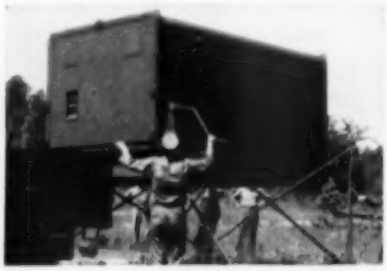

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AVIATION CALENDAR

(*Continued from page 5*)

Nov. 6-8—Third Annual Aero-Com Symposium, The Institute of Radio Engineers Professional Group on Communications Systems, Hotel Utica, N. Y.

Nov. 7-8—National Meeting, Weapons System Management, Institute of the Aeronautical Sciences, Statler-Hilton Hotel, Dallas, Tex.

Nov. 11—Plastics for Airborne Electronics, Regional Technical Conference, Society of Plastics Engineers, Hotel Ambassador, Los Angeles.

Nov. 11-13—Third IRE Instrumentation Conference and Exhibit (Data Handling), Atlanta-Biltmore Hotel, Atlanta, Ga.

Nov. 11-15—1957 International Air Safety Seminar, Flight Safety Foundation, Palo Alto, Calif. FSF-Aviation Week Safety Awards Dinner, Nov. 14. For Details write FSF, 468 Fourth Ave., N. Y. C.

Nov. 12-13—Seventh Aircraft Hydraulics Conference, Park Shelton Hotel, Detroit, sponsored by Vickers Inc. (invitation only).

Nov. 13-14—Mid-America Electronics Convention, Municipal Auditorium, Kansas City, Mo.

Nov. 13-15—18th Annual Convention, National Aviation Trades Assn., Hotel Adolphus, Dallas.

Nov. 17-21—Eighth National Plastics Exposition, International Amphitheater, Chicago.

Nov. 18-22—Third Norelco Electron Microscope School, Instruments Division, Phillips Electronics, Inc., 750 S. Fulton Ave., Mt. Vernon, N. Y.

Nov. 18-29—Technical Conference, International Air Transport Assn., Miami, Fla.

Nov. 20-22—30th Meeting, Aviation Distributors and Manufacturers Assn., Sheraton-Cadillac Hotel, Detroit.

Dec. 4-5—Symposium on high temperature strain gages, Aeronautical Structures Laboratory, Naval Air Materiel Center, Philadelphia 12, Pa.

Dec. 9-13—1957 Eastern Joint Computer Conference and Exhibit, Sheraton Park Hotel, Washington, D. C.

Dec. 16-18—Air Traffic Control Symposium: "The Mission and Methods of the Airways Modernization Board," sponsored by Franklin Institute, Philadelphia, Pa.

Dec. 18—Gas Turbine Development speaker: Rear Adm. S. B. Spangler, USN, Air Development & Materiel Center, at Engineers Club, Philadelphia, Pa.

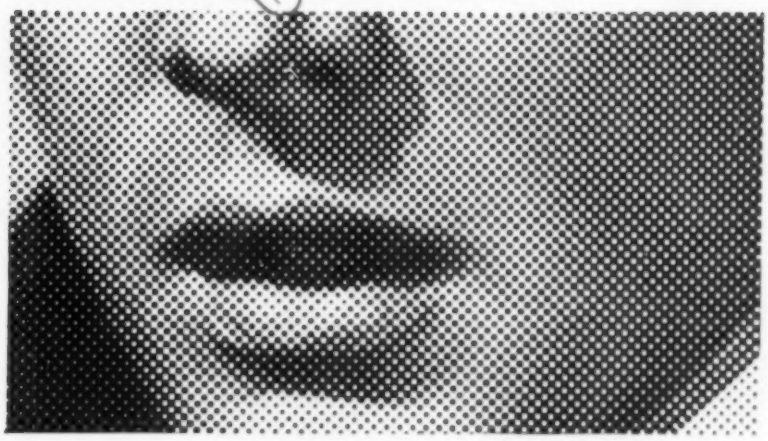
Jan. 6-8—Fourth National Symposium, Electronics Reliability and Quality Control Hotel Statler, Washington, D. C.

Jan. 29-31—Fourth Annual Meeting, American Astronautical Society, N. Y. C.

Jan. 30-31—Seventh Annual Instrument Short Course, sponsored by Southern California Meter Association and Los Angeles Harbor Junior College, at Los Angeles Harbor College, Wilmington, Calif.

Mar. 17-21—1958 Nuclear Congress, managed by American Institute of Chemical Engineers, 25 W. 45 St., New York 36, N. Y.

Mar. 17-21—Aviation Division Conference, American Society of Mechanical Engineers, Statler-Hilton Hotel, Dallas, Tex.



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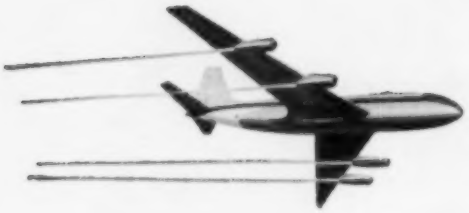

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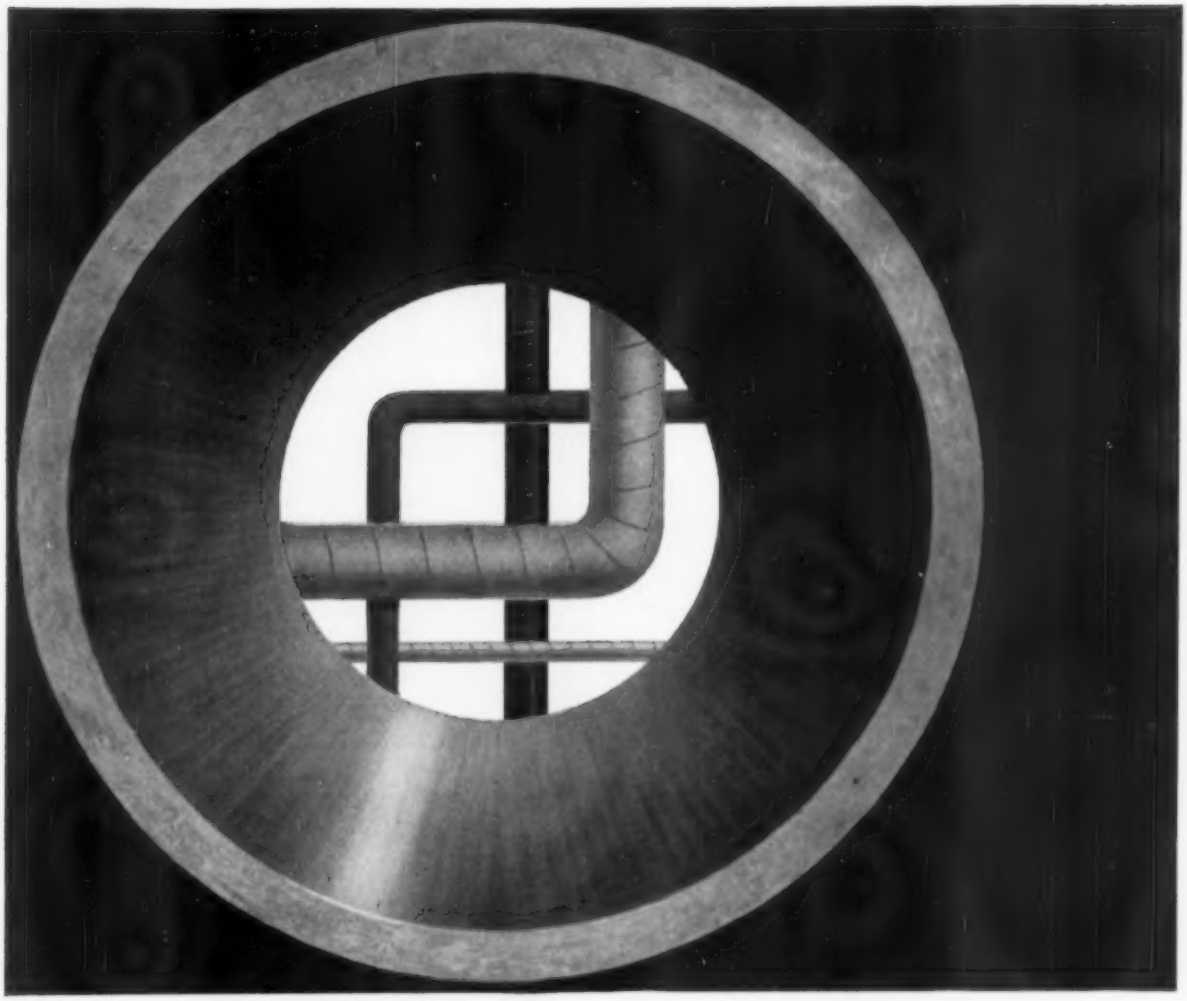

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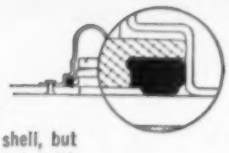
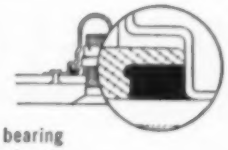


Before Attachment

Seal retracts into shell, but remains in contact with structure.



After Attachment

Installation forces bearing surface of sealed washer to contact structure, providing positive single point sealing.

Nutt-Shel has designed many new products to solve complex problems, but none has received greater acceptance than this self sealing dome nut. For integral fuel tanks, and other applications where positive sealing is required, this design has been proving its reliability for five years.

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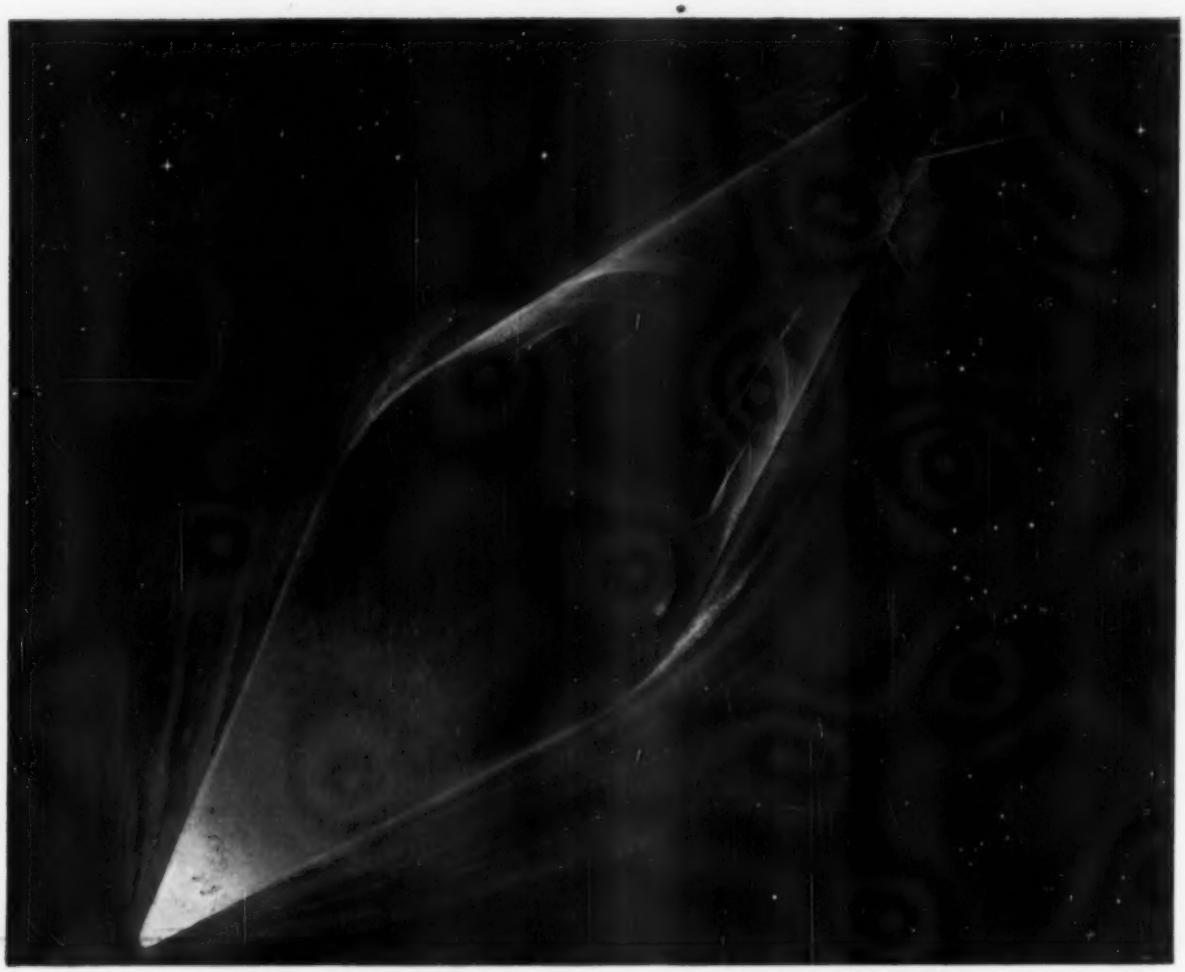
SOUTHWEST – CASHIN-TIPTON & ASSOC., San Diego 10, Calif.; McDONALD INDUSTRIAL SALES, Inc., Phoenix, Arizona;
SOUTH – The DYESS Co., Ft. Worth, Texas; RUSSELL ASSOCIATES, Inc., Atlanta, Ga.;
WEST – O. J. HARPER Co., Renton, Wash.; SELCAL SALES & ENGR. Co., Berkeley 2, Calif.



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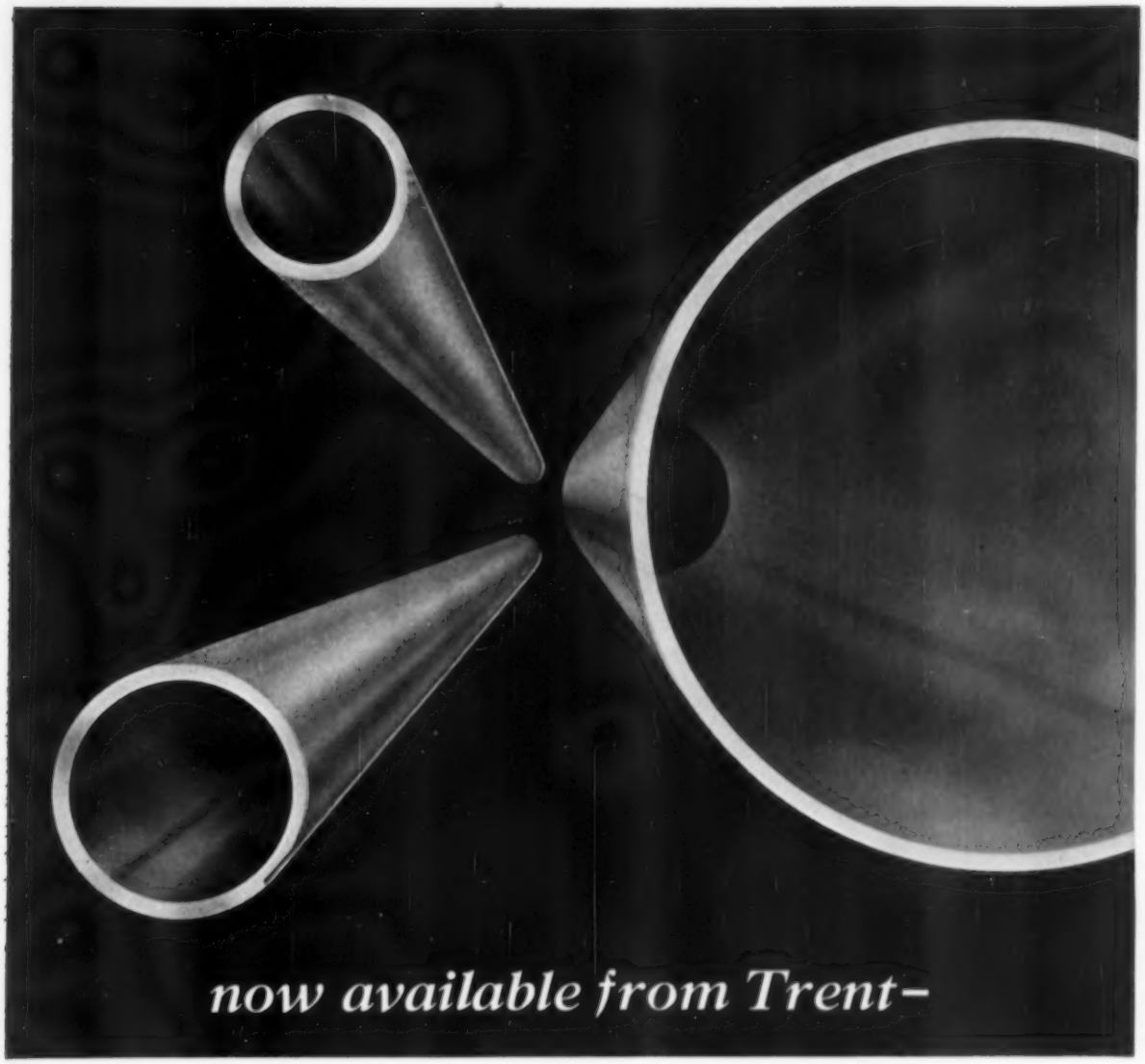

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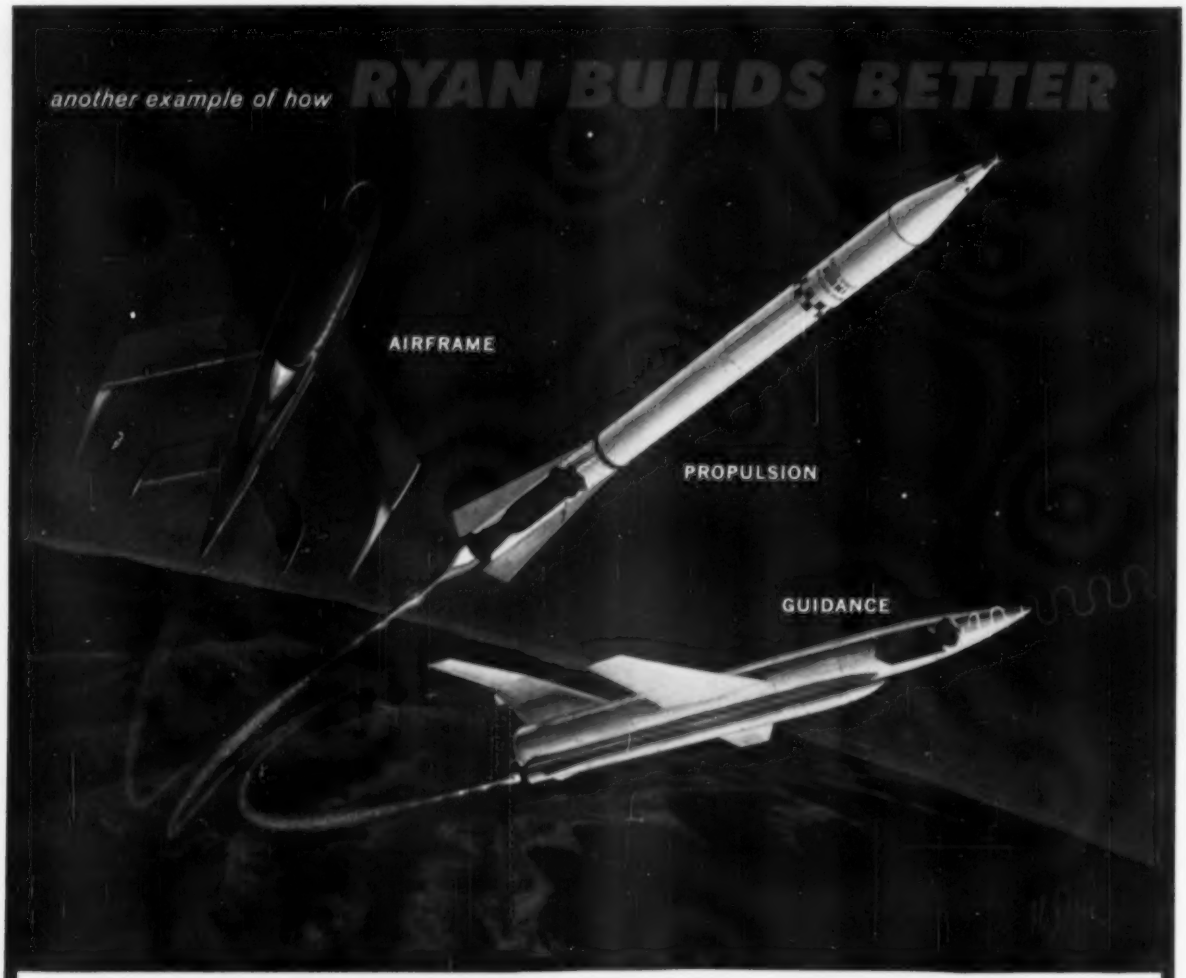

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Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351
Dallas 1—1712 Commerce St., Phone: Riverside 7-5117

European Office—1 rue du Temple, Geneva, Switzerland

PUBLISHER.....Robert W. Martin, Jr.
EDITOR.....Robert B. Hotz

ASST. MANAGING EDITOR (TECHNICAL)
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WASHINGTON.....Cecil Brownlow
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▶ Tourist passengers totaled 369,000, accounting for most of record 21% June/September increase.

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▶ SHAPE studies results of NATO competition, will probably recommend consideration of one or more of five entrants.

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COVER: Crater-pocked surface of the Moon is brought to within 250 mi. of the Earth by the magnification of ROTI Mark II missile tracker, which took the exclusive cover picture. Recording Optical Tracking Instrument, now installed at Melbourne Beach, Air Force Missile Tracking Center, Patrick AFB, Fla., was developed under a crash program specifically to track Atlas I intercontinental ballistic missile. See story, p. 110.

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EDITORIAL

Intelligence Without Leadership

Intelligence on the capability and intentions of any potential enemy is a vital ingredient in the formula for survival in a troubled world. In the past, there has been a good deal of justified criticism of the U. S. effort in the military and political intelligence field, but there has been major improvement on this score during the past decade. In fact, it is apparent that our intelligence apparatus is now furnishing our national leadership far more information, particularly on the spectacular scientific rise of the Soviet Union, than it can digest.

History is full of examples of disasters that overtake nations whose top leadership refuses to act on the basis of good military intelligence. It is pertinent to recall the vilification of Charles A. Lindbergh when he returned from his 1936-37 visits to Nazi Germany.

Lindbergh, then the best known airman in the world, went to Germany at the request of the U.S. Army Air Corps on the theory that the late Herman Goering's pride and vanity would induce him to show Lindbergh far more of German aerial developments than an ordinary visitor. The theory proved correct, and Lindbergh not only saw the new German fighter and bomber designs and the new factories in which they were being mass produced but also was permitted to actually fly such planes as the Me-109 fighter and Ju-88 bomber.

When Lindbergh returned to the U.S. and Britain, top political leaders were deaf to his warnings of the impending effect of German airpower. Only a few military airmen in both countries heeded his warning and did what they could to prepare for the inevitable storm. I remember listening to the late Gen. "Hap" Arnold tell a group of reporters in San Francisco not long before he died the story of how he talked with Lindbergh in the baseball bleachers at West Point to get his first report on German airpower. Without that data, Gen. Arnold told us, American airpower would have been hopelessly unprepared for facing the Luftwaffe in the air later. Yet for reporting these facts Lindbergh was personally vilified by political leaders who lacked the courage to face the hard news he dispassionately presented. Britain went down the road to the appeasement of Munich and the bloody disasters of Norway, France, Greece and Africa before the advent of courageous leadership was able to turn its tide.

The U.S. had double intelligence warning on the aerial attack on Pearl Harbor but its leadership failed to act in either case. The first intelligence came from the Navy's cracking the Japanese secret code and intercepting the radio messages that launched the Japanese carrier attack against Pearl Harbor. For reasons not yet made historically clear, these messages were never passed on to the U.S. military commanders in the Pacific whose forces were the Japanese target. Even after the Japanese planes were launched, they were detected by Air Corps radar in time to alert the air defenses of Hawaii. Here the chain of leadership broke down at its first echelon when a second lieutenant dismissed the radar reports and left Hawaii to take the first Japanese blow undefended.

During World War II, the Axis had its share of top leaders who were unable to absorb intelligence that did not fit their preconceived ideas. Adolf Hitler had ample intelligence warning of the two critical Allied invasions—first in North Africa and later in France. But his own preconceived ideas of military strategy prevented him from allowing his field commanders to act on this intelligence. By the time he released them to make proper dispositions of their forces, the invasion armies were successfully ashore.

We are now well along into a period where intelligence effort of all types has been producing a steady flow of solid technical information on Soviet progress in aircraft, missiles and space vehicles for a national leadership that appears to be incapable of digesting this information or acting on the problems it raises.

First real clue that the Soviets were on the way in the revolutionary post-war era of gas turbines, supersonics, rockets and outer space came in 1948 when USAF acquired the first western picture of a MiG-15 swept-wing fighter in flight. This photo was promptly denounced by the highest Defense Department authorities including the late James Forrestal, then Defense Secretary, as a fake produced by USAF for propaganda purposes.

When USAF and Navy pilots began fighting swarms of MiG-15s over Korea later against heavy odds authenticity of this photo was proved in blood.

Since the Korean war, there has been a steady flow from all types of sources on the size, scope and rate of progress of the vast Soviet technological drive to develop new aerial weapons. After the first Soviet atomic explosion in 1949, there were public displays of long-range jet bombers and supersonic fighters in the air shows of 1954; the development of giant helicopters and jet transports; by 1955, the first firings of an intermediate range ballistic missile; the next year, the ICBM program reached test firing stage, and, finally in 1957, the Sputnik satellite took to orbiting the earth propelled into space by the ICBM propulsion system.

In the face of this overwhelming mass of evidence on the growth of Soviet military strength from new technological weapons, our own national leadership has been executing a policy aimed at reducing our own atomic-airpower strength in being, artifically retarding the pace of our military technological development and thoroughly discouraging the best efforts of both military and scientific leaders concerned with this vital program.

President Eisenhower's most recent attempts to deprecate the achievement of the Soviet Sputnik satellite, his insistence that science be separated from the military and his continued refusal to tell the American public facts on the Soviet missile program that scientific intelligence has been reporting to him for two years (AW Oct. 21, p. 26) are not new phenomena.

As long ago as 1954, the President's Defense Secretary Charles E. Wilson was "pooh-poohing" new Soviet aircraft as "hand-built prototypes," even though they flew publicly in formations of 45 to 60 planes. It was Mr. Wilson who, in the spring of 1955, tried vainly to conceal from the American people the types and quantities of new Soviet fighters and bombers that flew publicly over Moscow in view of millions of Russians and foreign diplomats.

This country cannot continue to survive as free world's leader in face of the Communist challenge without leadership that has the integrity and courage to face up to the grim facts provided by our intelligence system.

—Robert Hotz

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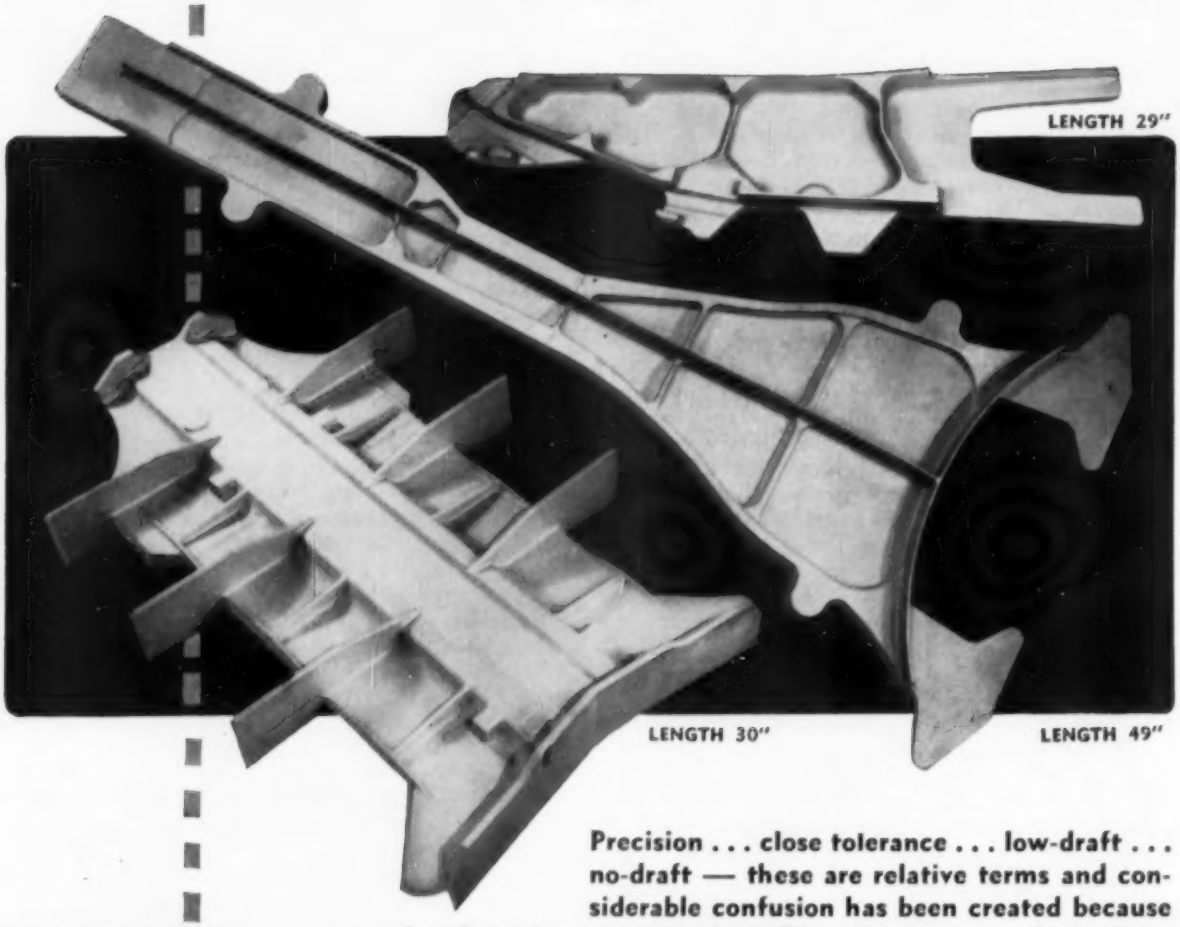

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WHO'S WHERE

In the Front Office

Merrill L. Bengtson, president of the Hufford Corp., a director, The Siegler Corp., Anaheim, Calif.

Rear Adm. Sir Matthew Slattery, chairman and managing director of Short Brothers & Harland Ltd., named director of Bristol Aeroplane Co., Ltd. and chairman of Bristol Aircraft Ltd., Bristol England. **C. F. Uwins,** former chairman of Bristol Aircraft, now deputy chairman of Bristol Aeroplane Co.

Russell R. Morgan, executive vice president and a director, Wheeler Associates, Inc., Cleveland, Ohio.

David Eaton, vice president-marketing, Reaction Motors, Inc., Denville, N. J. Also: **Delacey Ferris,** chief engineer, and **Dr. Edward Seymour,** director of research.

Charles L. Lord, a vice president and controller, Electronic Communications, Inc., St. Petersburg, Fla.

Jack L. Shafer, vice president-sales department, Tensolite Insulated Wire Co., Tarrytown, N. Y.

Richard C. Diehl, vice president-operations, Universal-Cyclops Steel Corp., Bridgeville, Pa.

Walter C. Robertson, a vice president, American Bosch Arma Corp., Hempstead, N. Y.

H. L. Thackwell, Jr., vice president, Grand Central Rocket Co., Redland, Calif. Also: **Stanley Waxman,** assistant vice president-operations, and **Angus M. Scott,** assistant director of projects.

Capt. Gould Hunter (USN, ret.), administrative assistant to the president and executive vice president, Eitel-McCullough, Inc., San Bruno, Calif.

Brig. Gen. John M. Sterling (USAF, ret.), assistant to the vice president-European operations (Paris), Republic Aviation Corp., Farmingdale, N. Y.

Honors and Elections

Dr. Clifford C. Furnas and **Gen. James H. Doolittle** have received honorary Doctor of Engineering degrees from The University of Michigan.

Gen. James H. Doolittle, Maj. Gen. Albert Boyd, and **Adm. William Trapnell** (USN, ret.) received awards for pioneering work in experimental test flying at the first annual awards banquet of The Society of Experimental Test Pilots. An award also was presented in absentia to **Howard Hughes.**

Changes

Frank G. Denison, director-research and development, and **John Dill McKenney,** principal engineer-research and development section, Clary Dynamics, division of Clary Corp., San Gabriel, Calif.

J. J. O'Brien, manager, AiResearch Manufacturing Company of Arizona, division The Garrett Corp., Los Angeles, Calif. **Harrison Holzapfel** succeeds Mr. O'Brien as manager of the AiResearch Aviation Service Company.

James W. Blumer, manager-aircraft sales, Industrial Sales Department, Libbey-Owens-Ford Glass Co., Toledo, Ohio.

INDUSTRY OBSERVER

► Both the Convair Wizard air defense system (AW Oct. 21, p. 27) and Lockheed's Pied Piper satellite reconnaissance system (AW Oct. 14, p. 26) will be under the cognizance of Air Research and Development Command's Ballistic Missile Agency headed by Maj. Gen. Bernard A. Schriever in Los Angeles. These are the first two USAF projects in this agency that will have no connection with the Ramo-Wooldridge Corp., which has had technical supervision over the Convair Atlas, Douglas Thor and Martin Titan ballistic missile programs.

► **At least three aeromedical scientists have volunteered to ride in a ballistic test vehicle to obtain personal subjective reactions to space flight. Seriousness of the offer indicates the degree of faith in current recovery systems, helps establish a bench mark to measure progress in solving the re-entry problem.**

► Winner in WS-110A chemical bomber competition between North American Aviation Inc. and Boeing Airplane Co. is scheduled to be announced in December. Air Force team is now at Boeing in the course of final evaluation stage.

► **Present Convair Atlas and future Martin Titan intercontinental ballistic missile test rounds cost in the neighborhood of $2 million ready to fire. Just 10 years ago, cost estimates of about $1 million per ICBM test round were dismissed by Army Ordnance officers as ridiculous.**

► Watch for a British attempt to push the official absolute world speed record to 1,500 mph. with an improved version of the Fairey FD.2 research plane. Peter Twiss, same pilot who set the present 1,132 mph. record in the Delta, would pilot the improved version.

► **Among the "might-have-been" satellites was a proposal for a three-stage unit which many experts feel would have put a U.S. vehicle in orbit as early as February, 1956. Proposal called for three standard rocket vehicles—a Martin-built Viking, a second-stage Aerojet Aerobee and a third-stage Deacon solid-propellant rocket.**

► Cockpit temperature in Convair F-106 has been contained in 65-90F range using electric anti-fogging in laminated side panels made of stretched plexiglass outside; Sierracin 611 with electrically conductive Sierracote for inside panel and vinyl interlayer. Cockpit temperature in Convair F-102, using hot air anti-fogging, has been as high as 140F.

► **Minneapolis-Honeywell's Monrovia, Calif., facility is pushing work on ASROC ship-to-underwater missile. Missile is essentially a solid propellant, rocket-boosted torpedo that is fired through the air for a considerable range, then enters water where electric-powered torpedo is directed by homing device to the target.**

► Radioplane Co.'s XKD4R-1 drone has been successfully test flown with rocket power for three to four minutes at speeds of about 400 kt. at Naval Air Missile Test Center, Point Mugu, Calif. Tests followed numerous unpowered drops from McDonnell F3H. Army will launch its version of the drone, the RP-76, from bailed F-89, later from Radioplane's RP-77DL drone.

► **Lockheed F-104s, originally scheduled to become operational with the Air Defense Command in Hamilton AFB, Calif., last April, are now scheduled to be phased in at the end of next month. Aircraft has had stability and engine relight problems which reportedly have been cured.**

► Defense Department officials say the military requirements put into the three-ton helicopter wanted by the services (AW Sept. 30, p. 23) will surpass commercial performance requirements, that its performance will be even better than the heavy duty helicopter wanted by the International Air Transport Assn.

► **Temco's rocket-powered target drone has been troubled by pitchup at the moment of separation from the mother plane.**

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Washington Roundup

New Soviet Surprise?

Speculation as to what new technological achievements the Soviet Union will announce on Nov. 7, 40th anniversary of the Bolshevik revolution, is led by a guess that they will say they have flown an atomic aircraft.

Other bets are announcement that they have shot a rocket to the moon, even though some conditions for such a launching will not be favorable at that time, launching of a second and larger satellite; great display of a missile-armed, streamlined attack force in Moscow.

Meanwhile, Sputnik has traveled more than seven million miles, survived the heaviest concentration of a several-day-long meteor shower and is behaving about as predicted. Orbit is precessing westward at 3.0 to 3.1 degrees a day and astronomers now say previously noted disturbance of the orbit was due to earth's equatorial bulge.

Moon Over Canaveral

Continued criticism and the rising of the Soviet satellite have brought partial relaxation of Defense Department's policy of refusing to identify missiles fired from Cape Canaveral, Fla., in full view of the public (AW Oct. 7, p. 26).

Assistant Secretary of Defense for Public Affairs Murray Snyder said last week the missile test program now "has reached a stage where certain information may now be made public."

Change came in time for firings of Air Force Thor and Army's Jupiter IRBMs and Vanguard TV-2 test vehicle to be identified, but several firings of smaller missiles made a few days before and even after the policy change were not identified. They included: static test firing of a Thor three nights before; firing of a Lockheed X-17, now a test vehicle for Navy's Polaris IRBM, one day before; firing one day after that probably was another all-automatic launch of Bomarc interceptor missile.

Defense said TV-2, testing the General Electric first stage engine, reached 109 mi. altitude and a speed of 4,250 mph. on a 140 sec. flight and fell into the Atlantic 328 mi. offshore. Jupiter, it said, took its prescribed course and landed in its pre-selected target area. One Air Force partisan suggested the pre-selected target area was the Atlantic Ocean.

Quarles on the Spot

Deputy Defense Secretary Donald A. Quarles will be a primary target of the Joint Atomic Energy Subcommittee on military applications headed by Sen. Henry Jackson (D.-Wash.) when it holds hearings shortly after Congress reconvenes. The reason: Over the protests of subcommittee members, Quarles persisted at an executive session in August in defending cutbacks in the missile program, including the elimination of overtime work. The session was called as a result of the Soviet announcement that it had successfully fired an intercontinental ballistic missile.

Administration: GOP Challengers

Two of the three Republican members of the Senate Preparedness Subcommittee, which probably will hold public hearings before Congress reconvenes in January, are publicly protesting the administration's attitude toward satellite and missile development. They are Sen. Styles Bridges (N.H.), also ranking minority member of the Appropriations Committee, and Sen. Ralph Flanders (Vt.) (see page 29). The third Republican member of the subcommittee is Sen. Leverett Saltonstall (Mass.).

Last week, Bridges declared that he is "deeply disturbed at the grossly misleading statements" being made on the Soviet earth satellite achievement "by ostensibly responsible spokesmen" for the administration.

The comment of Presidential Assistant Clarence V. Randall dismissing the Russian satellite as a "silly bauble," Bridges said, "is completely beyond my comprehension.

"As a Republican, I would like to be able to support spokesmen of the administration on matters of national interest. However, the welfare of the U. S. transcends political considerations, and I cannot permit such irresponsible statements as that made by Mr. Randall to go unchallenged. Such statements reflect either ignorance of the facts or an attempt to confuse and mislead the American people.

"The mere fact that the Soviets have been successful in launching their satellite indicates clearly that they possess the same type of technical knowledge that is required to project an intercontinental ballistic missile. Military implications of such technical knowledge in the hands of a potential enemy to the U.S. are tremendous in scope.

"I had hoped that the one constructive result of the Soviet accomplishment would be to shake many of the people of this country out of the dangerous complacency which has developed with regard to the Soviet menace. . . ."

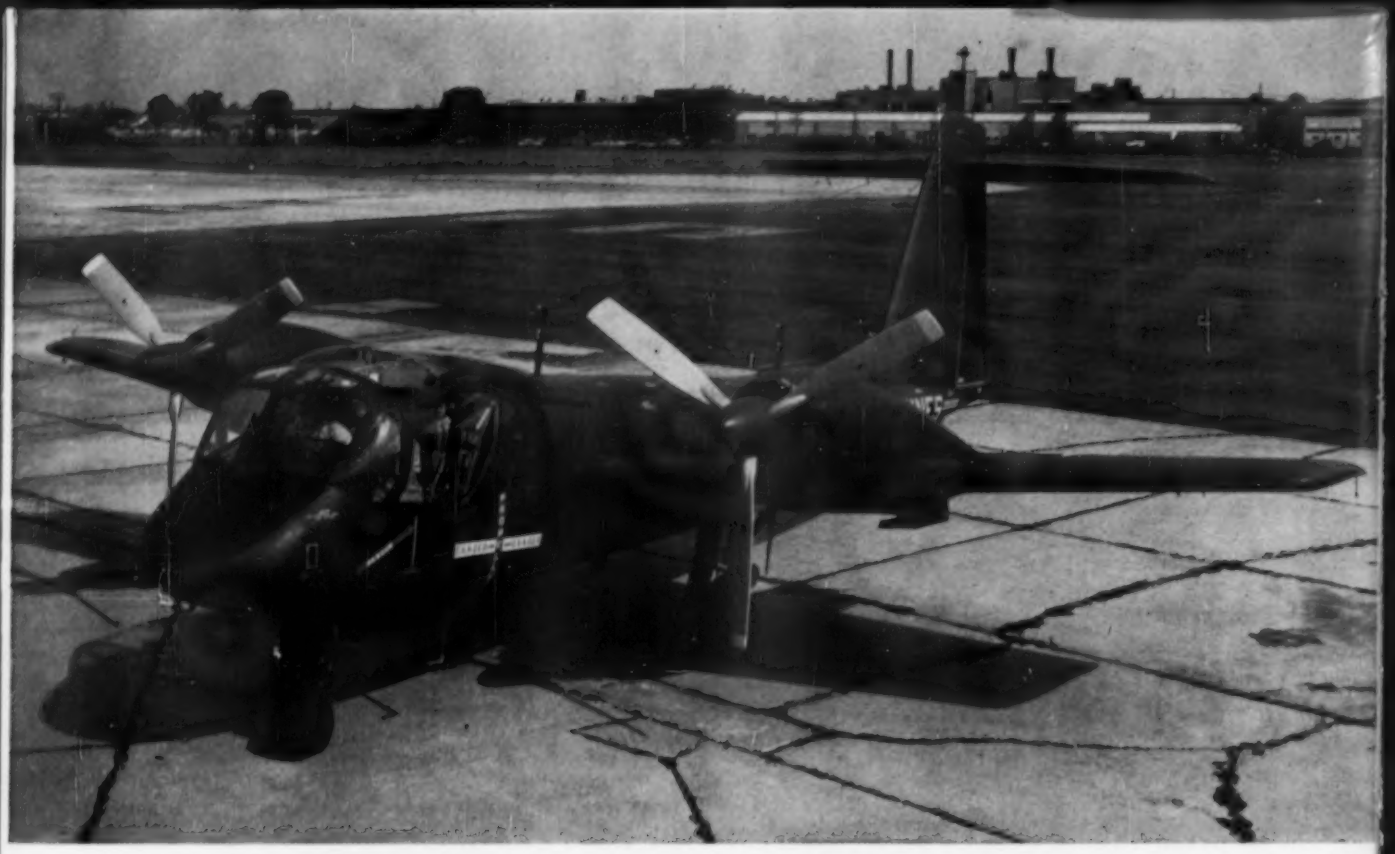
Watchful Eye

Departure of the Robert Tripp Ross-Donald B. McCammond axis from the Defense Department's Public Affairs Secretariat has not ended the petty criticism of service speeches and proposed press releases. Under Murray Snyder, former White House aide, Army Secretary Wilber Brucker still has his speeches returned with extensive changes after they are sent to the "front office" for policy approval. Common assumption in Army public information circles is that the White House is keeping close control of defense statements to the public. Snyder's last job was as top aide to James Hagerty, White House press secretary. Among other petty annoyances is a demand that all papers sent to Snyder's office for clearance be carried by top officers and the job not delegated to mere captains and majors.

Discount Reversal

Airlines which recently dropped the 10% discount on military traffic (AW Oct. 7, p. 25) have reversed their field and now want to reinstate the discount. Military transportation officers normally schedule traffic over the shortest route at the lowest available rate and, consequently, have been diverting their traffic to those airlines still offering the discount. The four trunkline carriers and the two local service carriers that discontinued the discount are feeling the pinch, particularly since October's general passenger traffic level is at such a low ebb. Original purpose of the discount was to place airlines in a stronger competitive position with the railroads in developing military traffic. Recent increases in rail rates, however, appeared to eliminate the need for the discount.

—Washington staff



Mockup Shown of Grumman's New Observation Plane For Army, Marines

Mockup of Grumman turboprop observation plane for the Army and Marine Corps (AW May 27, p. 28) is being displayed at Ft. Meyer, Va., during the U. S. Army Assn.'s annual meeting. The two place, 275-kt. AO-1 Mohawk can land and take off over a 50 ft. obstacle within 600 ft. Ground run would be about 350-400 ft. Present Mohawk can be equipped with skis to operate off of water, mud, snow, and sand, but services agree that the water base capability is of little use to them. Skis will probably be redesigned for use on mud, snow and sand. Mohawk now weighs about 10,400 lb. Its Lycoming T53-L-3 engines each develop 1,005 hp. providing thrust loading about the same as the Grumman F8F Bearcat. This indicates its maneuverability and climb performance. Reconnaissance from the initial version of the Mohawk will be handled by the observer and camera equipment. Eventually the aircraft will also carry radar, infrared, television, and two other undisclosed systems for obtaining information. The Mohawk has three external racks under each wing. The inboard rack can carry a 1,000 lb. load and the two outboard racks 500 lb. each.

Project Stratoscope Reveals Sun Data

Future research projects would include the study of planetary atmosphere, satellite observatories.

By Evert Clark

Washington—Plans for projects ranging from the study of planetary atmospheres to satellite astronomical observatories were revealed by the Office of Naval Research last week as a result of complete success of two Stratoscope balloon flights during which the sun was photographed from above most of the earth's atmosphere.

Photographs taken in flights Sept. 25 and Oct. 17 (see p. 116) already have indicated that the sun's gaseous eddies are much more turbulent and have much more structure and organization than was previously believed. Photos included the sharpest ever taken of the sun's edge (see picture below).

Some of the phenomena revealed by the flights are "quite bewildering," Dr. Martin Schwarzschild, chief investigator, said. He is Eugene Higgins Professor of Astronomy at Princeton University, prime contractor for the instrumentation portion of Stratoscope.

Dr. Lyman Spitzer, Jr., director of the observatory and a major investigator of controlled thermonuclear reactions, said knowledge gained through the Stratoscope flights might contribute to the control of fusion by helping to explain interaction of magnetic fields and hydrogen gases.

Stratoscope, which has cost approximately $115,000, was cited as a good example of a basic research project requiring cooperation among two services —Navy and Air Force—and university, industry and private scientific investigators.

Stratoscope Timetable

Tentative timetable for later phases of Stratoscope and related projects:

• **Spectroscopic study** of planetary atmospheres from a manned balloon within the next year. Project is under the direction of Dr. John Strong at Johns Hopkins University. Skyhook balloon will lift a modified project Stratolab gondola containing a 16 in. telescope to about 85,000 ft. Guidance system and telemetry will differ from those used in Stratolab. Man will provide the simplest aiming system for the telescope and spectroscopic equipment and will have the option of training the equipment on any interesting phenomenon he might see other than the planets. He probably will be Malcolm D. Ross, physicist in ONR's air branch, one of two men to make the two ONR-sponsored Stratolab flights so far.

• **Stratoscope II** flight with a 36 in. telescope, recording on film. This could come in 1960 or 1961.

• **Stratoscope II** flight with a 36 in telescope and television camera. Expected approximately in 1962 or 1963.

• **Satellite observatory carrying** a six or 12 in. telescope weighing a few hundred pounds, and television. No date is given for this step and ONR emphasized that there are "no definite plans for it"—only expectations.

• **Orbiting of a large telescope.** Dr. Schwarzschild said this is a "dream for sometime decades from now."

Funds a Question

All steps beyond the two flights already completed depend on availability of funds as well as other factors. Work has not even begun on Stratoscope II, but ONR and its Stratoscope I contractors are quite encouraged by results so far.

Dr. Spitzer said long-range hopes for satellite observatories have no relation to any military reconnaissance satellites or any other military project.

But if there were a military necessity for satellite observatories, "of course we could do it very rapidly," Dr. Spitzer said. He and Dr. Schwarzschild said they know of no work under way in the Soviet Union similar to Stratoscope.

Each Stratoscope flight has produced 8,000 photographs of the sun on 35 mm. film at one second intervals. First flight on Sept. 25, the 10th anniversary of the first Skyhook flight, photographed the sun's core from an altitude of 81,500 ft. Second, on Oct. 17, made several scans from a point halfway between the limb (edge) and the core, out to the limb and back again. Photos show a segment of the limb approximately 30,000 mi. long and sharper than any taken through earth-bound telescopes.

Air Research and Development Command's Cambridge Research Cen-

LIMB or edge of the sun is photographed with unprecedented sharpness from a balloon at an altitude of 83,000 ft. Hot turbulent eddies are visible in the solar atmosphere quite close to the limb. Bright elongated area, starting at arrow, is a hot magnetic storm. Photograph, taken as part of Project Stratoscope, encompasses a 30,000 mi. sweep of the sun.

ter helped ONR fund the solar instrumentation portion of Stratoscope.

Contractors are the Princeton University Observatory for Instrumentation; Balloon Department of General Mills Inc. for the balloon, suspension system, launching and recovery of balloon and equipment; Perkin-Elmer Corp. for design and construction of the solar telescope and camera; University of Colorado's Research Service Laboratories and the Upper Air Laboratory of its Physics Department for the pointing control. Dr. John W. Evans, superintendent of the Sacramento Peak Observatory helped with initial planning and secured some financial help from AFCRC for initial development of instrumentation. ONR project officers are Dr. Sidney G. Reed, Jr., Physics Branch; Lt. Cmdr. Edmond A. Basquin, Air Branch.

USAF Research Cuts Are Deep; Cambridge, Rome, OSR Hard Hit

Washington—USAF research and development programs are being severely crippled by spending ceilings plus the shift from obligation to expenditure financing, in spite of official assurances that cuts will not exceed 8% and are not being administered across the board.

Hardest hit Air Research and Development Command centers are still Cambridge Research Center, Rome Air Development Center, Wright Air Development Center and Air Force Office of Scientific Research.

Effect of current fiscal policies, imposed on USAF by Defense Department and on Defense by the Budget Bureau, is to virtually eliminate any hope of beginning new work with Fiscal 1958 money.

Vouchers Not Paid

Many Fiscal 1957 contracts have been terminated, and vouchers for work done so far are not being paid until after Jan. 1 by some centers and until after March by others.

Although research and development, particularly basic research, has been paid greater lip service since the launching of the Soviet satellite, policy of cutting back research work has continued at an even greater pace as the machinery for bringing spending under control begins to work.

Defense Department last week was preparing new statements on research funding, partly to offset disclosure that former Secretary Charles E. Wilson ordered the services last August to reduce by $170 million the amount of procurement and production funds they used to support research, development, testing and evaluation.

USAF spokesmen said the Wilson order will not mean additional cuts above the 8% expected for Air Force programs (AW Sept. 16, p. 26), even though Defense took steps to keep the order from becoming public at the time it was issued.

Defense Secretary Neil H. McElroy said last week that officials have been "taking a hard look (at) the rate at which we are progressing with research activities."

Industry observers believe, however, that no appreciable increase in research and development spending is yet in prospect. Even if it were ordered immediately, what one observer called "the slowing down of the slowdown," would take some time because it has now gathered momentum.

Effects of Cuts

Despite assurances that the overall final percentage of expenditure cuts will not be high, here are some of the effects the policy is having:

• **Missile programs** and missile testing at Patrick AFB, Fla., still were on a five-day week as Defense officials took their "hard look." McElroy said in an Oct. 18 memorandum to the three service secretaries that "all requests for permission to utilize overtime in the missile programs of which I am aware have been approved by this office.

"It appears that our missile schedules now represent the best balance of technical knowledge, trained manpower and test installations that we can make at this time.

"I am not aware of any regulations that have been imposed which are presently hampering our efforts to carry out these schedules."

McElroy called for "continuing attention to the removal or modification of any regulations which could conceivably impede progress in these fields."

He also asked that "a short weekly memorandum" on missile progress be furnished to Assistant to the Secretary of Defense for Guided Missiles William Holaday, "marking a copy for my personal attention," and assured the secretaries and their staffs of "my constant availability to assist in any way" with problems.

• **Cambridge Research Center** has or will have canceled approximately half of its Fiscal 1957 programs and will have no Fiscal '58 funds for any new programs unless policies are changed. A great many of these are exploratory research contracts. Many development contractors are being told they can submit invoices for work done but the invoices will not be paid until next March.

• **Rome Air Development Center** has canceled all Fiscal 1957 and 1958 contracts with some companies and has told some contractors their bills will not be paid until after Jan. 1.

• **Wright Air Development Center.** Contract terminations are reported to be in the hundreds. Administrative effort being devoted to determining expenditure rates, canceling contracts, stretching out others and adjusting others is so heavy no new contracts could be written even if funds became available, some officers say.

• **Office of Scientific Research.** Faced originally with an order that would have resulted in an across-the-board cut of 5% in all existing contracts, AFOSR suggested a method which would have allowed selective cutting but still would have achieved an over-all reduction of 5% in expenditures. This was rejected at higher levels. OSR next faced what amounted to a 50% cut in its budget (AW Sept. 16, p. 27), but bitter protests from university and industry contractors brought a reversal. Now OSR has sent out letters to approximately half of its 600 contractors ordering a 5% across the board cut in remaining unliquidated obligations under contracts which expire after Dec. 31.

Uncontracted Proposals

It, too, is having to let new proposals go uncontracted for, pass up renewal of many existing contracts, and postpone payment of its bills. The new letter to contractors asks them to reduce estimated cost by "not less than 5% of the unliquidated obligation of the contract as of 30 Aug. 1957," or stretch out performance time to achieve equivalent reduction in expenditure rates, or "effect a partial termination" to realize the same saving.

OSR also has been directed to incorporate a monthly reimbursement limit into contracts.

Contractors again are objecting strenuously, this time more to the methods employed than to the amount of the cuts. They point out that university contracts usually are written on a cost-sharing basis and contain no "fat" that can be readily cut; that basic research costs do not run on a flat rate from beginning to end of contract or beginning to end of school or fiscal year, and expenditure limits imposed on a monthly basis are extremely unrealistic.

One contractor said imposing a steady monthly spending rate requires the contractor either to bill the government dishonestly or to "carry the government until it can pay its bills," and neither prospect is a sensible one.

Congressmen Fear Second Soviet 'First'

By Katherine Johnsen

Washington—Demands for accelerating the U.S. defense program mounted last week as congressmen—both Republicans and Democrats—showed concern that the launching of the Soviet earth satellite is only one "first" for Russia and that another will follow.

Rep. Melvin Price (D.-Ill.), chairman of the Joint Atomic Energy Subcommittee on Research and Development, returned from Russia convinced that before long the Soviets will be flying an atomic powered aircraft. The Russian scientist who escorted Price and other members of the subcommittee assured them that this was so. "And I believe him," Price said. "The Russians know the tremendous psychological value of startling military 'firsts,' and they move forward. Their plane probably won't be perfect, but I have little doubt that it will be flying. The U.S. has been puttering along in the hope of eventually developing the perfect atomic plane."

Sen. Richard Russell (D.-Ga.), chairman of the Senate Armed Services Committee, said the U.S. could, in a measure, regain prestige by producing the first atomic plane but added that the Defense Department has "very foolishly" cut back the program for the current fiscal year by two-thirds.

Congressional Drives

Congressional support for action in two directions is strong:

• **Reorganization.** Interservice rivalry and inadequate military-civilian scientific coordination is a prime target of congressional criticism. Sen. Mike Mansfield (D.-Mont.), Democratic whip, has proposed establishment of a Secretary for Research and Development with full Cabinet status.

• **Encouragement of scientific** advancement. Sen. Henry Jackson (D.-Wash.), as chairman of a special NATO committee, will present a comprehensive program to the Third NATO Parliamentary Conference in Paris early next month. Other U.S. members of the special group which drew up the program include Dr. R. Killian, president of Massachusetts Institute of Technology; Dr. Maria Geoppert Mayer, professor, The Enrico Fermi Institute for Nuclear Studies, and Dr. Rubin Mettler, program director of USAF's intermediate range ballistic missile program at Ramo-Wooldridge Corp.

Urging an "Atlantic community talent development program," the NATO committee in its report recommends:

• **NATO-wide employment clearing house.** Noting the shortage in industrialized NATO countries, the committee observed that "in other areas, there is underemployment or actual unemployment for scientists and engineers, particularly those just finishing their training."

Listings of employment opportunities and applicants would be assembled in one register.

• **NATO-financed awards program** for scientific teachers and students in secondary schools.

• **NATO-financed cooperative training** and research projects, summer institutes and exchange-of-persons programs.

• **Establishment of an Atlantic** Community Foundation, composed of two representatives of each NATO nation, to administer the program.

It is expected that the Jackson committee's proposals will receive firm backing in Congress.

Meanwhile senators and representatives are cautious in backing increased defense expenditures as a solution. The general attitude is that the answer lies in more efficient utilization.

Individual Reaction

Developments last week included:

• **Sen. Ralph Flanders** (Vt.), Republican member of the Senate Preparedness Subcommittee which has launched a study of the satellite and missile programs (AW Oct. 14, p. 31), complained that "there is too little indication that the needed action is being taken for bringing our missile program to a successful completion. That program has lagged for many months." Declaring that the answer does not lie "in more billions," but "in competent, authoritative management of scientists, engineers, and military experts," Flanders proposed that direction of missiles programs be "turned over" to MIT President Killian. He added:

"The billions we have appropriated and spent have been getting in each other's way. They have been spent on service rivalries, on committees and

Jupiter Night Firing

Army Jupiter intermediate range ballistic missile is launched at Cape Canaveral, Fla., at night. Firing marked break in precedent since Department of Defense officially identified a missile in test launching for first time.

subcommittees, on coordinating officials and committees, on advisory committees and subcommittees, on channels of communication up, and down, and sidewise in the trackless maze of the Pentagon—a building deliberately designed to facilitate running around in circles."

• **Sen. Hubert Humphrey** (D.-Minn.), chairman of the Senate Disarmament Committee and a member of the Foreign Relations Committee, urged that former Secretary of Defense Charles Wilson and Budget Director Percival Brundage, be called for a Senate hearing. He cited as "one further incredible disclosure of reckless risks being taken in our national security," the disclosure that through Turkish-based radar "the Administration apparently knew of Soviet missile progress at the same time it was slowing down our own missile development program. . . .

"If President Eisenhower himself knew these facts," Humphrey commented, "he owes the American people an explanation. In any case it was his business to know the facts, and to act accordingly—and this he and his administration failed to do."

• **Sen. Homer Capehart** (Ind.), ranking Republican member of the Banking and Currency Committee and a member of the Foreign Relations Committee, cautioned against "hysteria." "To say that this single achievement (Sputnik) seriously jeopardizes our defense is approaching sheer nonsense," he said. "To be thrown into hysterical spending because of it would be wrong. It is conceivable even that a reappraisal of the emphasis to be placed on the various phases of our defense effort might result in a reduction in defense spending."

Capehart said "the inventor of the radio, which was more startling than Sputnik, was Marconi, an Italian, but, of course, history proves that we were the ones to develop it and got the most use and good from it."

He said he is impressed with the "showmanship" of Russian leaders which "makes Billy Rose look like a second-rater. Through a tremendous sacrifice on the part of their people, they have the ability to develop a gadget and make it a cause of worry for the foreign offices all over the world."

• **Sen. Mansfield**, criticizing interservice rivalry, called for "one centralized agency to which would be attached the best scientists from the services and civilian life" to administer missile programs. He commented that "it is time to take the Wernher von Braun team of Redstone Arsenal and put it up where it belongs in the rocket field. At the present time, it and the Army are at the bottom of the missile totem pole despite the fact that the only real advance in the missile field—the Redstone—was developed by them."

• **Top policy group** of the Democratic National Committee issued a detailed statement denouncing defense cutbacks point-by-point. In addition to criticizing reductions in the missile programs and the long-range jet tanker and bomber programs, the group noted: "Development and production of modern airlift cargo planes, so necessary to meeting foreign commitments, have been just about eliminated." Sen. Estes Kefauver (D.-Tenn.), a member of the Senate Preparedness Subcommittee, and Thomas K. Finletter, former Secretary of the Air Force, are members of the policy group.

• **Rep. Thomas Lane** (D.-Mass.) characterized the administration's defense attitude as "Hamlet-like—to lead. . . or not to lead . . . that is the question." He added: "It is 11:30 p.m. and all is not well. The hour is late, and the time left for constructive leadership is running out."

Administration Divided on Sputnik

Washington—Divided reaction to the implications of Russia's satellite launching was still evident in public statements by administration officials last week.

Clarence Randall, special assistant to President Eisenhower for foreign economic matters, called Sputnik "a silly bauble in the sky" and said he is "gratified that our nation was not first."

President Eisenhower said he will make a series of speeches telling the public why it should have confidence in the nation's economy, its scientific progress and its defense programs.

"If I may be able in these talks to set out in proper perspective the truth and facts on these matters, no time consumed will be too much, no inconvenience will be too great," the President said.

Rebuttal

Army Secretary Wilber M. Brucker, on the other hand, spoke of "the urgency of this critical hour and the quality of sacrifice it demands from each one of us," continuing the talk of "sacrifices" first voiced last week by Vice President Richard M. Nixon, Secretary of State John F. Dulles and Deputy Defense Secretary Donald A. Quarles (AW Oct. 21, p. 27).

But, like Quarles, Brucker tended to put the burden for underestimating the threat of Soviet strength on the public, rather than on administration leaders. Brucker also put some of the blame on Congress for cutting the Fiscal 1958 defense budget.

Randall said Russia used a military missile to launch its satellite. If this country had used a military missile to launch the first satellite, Randall said, other countries would have directed propaganda against the U.S. for using the rocket as a threat.

Supermarket U.S.A.

Randall said programs of economic aid and cooperation are much more important to world affairs than earth satellites. As an example of the way in which American businessmen can support the government in international relations, Randall cited the "Supermarket U.S.A." exhibit sponsored by the National Association of Food Chains and the U.S. Department of Commerce in Zagreb, Yugoslavia.

Brucker said announcement of a Russian intercontinental ballistic missile firing, a satellite launching, etc., "arouses apprehension and impels efforts to strengthen our defenses," but the effect "seems to wear off very quickly, and many people return to an attitude of complacency."

"In this age, complacency is a luxury we cannot afford," Brucker said. "In order to meet the Soviet challenge and maintain our national integrity, we must squarely face all the unpleasant facts and make a sustained effort to build stronger than ever.

"Not for a moment can we forget the urgency of this critical hour, and the quality of sacrifice it demands from each one of us. Without regard to partisanship, this is our country's cause," Brucker said.

"Alternating peaks and valleys of effort and expenditure are wasteful," Brucker continued. "It does little good to raise strong defenses for a while, and then follow a period of complacency

Boost for Polaris

Washington—Navy is tripling its funding for the Polaris fleet ballistic missile. Lockheed, missile system manager for the project, has been given a $62.1 million contract to accelerate development and push the Polaris into operational status "as rapidly as possible." The contract, which extends the program through Fiscal 1958, increases the total amount of contracts held by Lockheed Missile Systems Division on the Polaris to $82.6 million. Previous $20.5 million contract was for initial research, development and testing.

Polaris test vehicle, a modified version of Lockheed's X-17 research rocket, was fired from USAF Missile Test Center, Patrick AFB, Fla., early last week.

Atomic Depth Bomb

Washington—Navy reported last week it has an operational air-dropped atomic depth charge, called Betty, which is carried by Grumman S2F-1 Trackers and Lockheed P2-V Neptunes. This apparently is in addition to Lulu, an air-dropped atomic anti-submarine weapon (AW Nov. 5, p. 23) with an underwater lethal range measured in miles.

when we let down our guard. . . .

Quarles also has expressed concern "that this nation may not recognize and properly evaluate the magnitude of this threat or that it may be unwilling to make the personal and financial sacrifices which are inescapable if we are to maintain positive, effective and convincing deterrent forces."

British Gain Initial Win Over U.S. In ICAO Navigational Aid Dispute

Montreal—British have won the first round in their fight for international adoption of the Decca area coverage navigation systems over opposition of the U. S. at Sixth Communications Division meeting of the International Civil Aviation Organization.

British success is that the meeting has recommended to ICAO's Air Navigation Commission that an international meeting be held "at the earliest practicable date . . . to reach conclusions on short distance aids." The terms of reference from recommendation 3.3/10 are for the meeting to:

- **Define** existing problems and those anticipated in respect to various operational environments.
- **Consider** ways of solving problems in operational terms.
- **Establish** quantitative and qualitative requirements respecting facilities required for solutions resulting from discussions (of above).
- **Review** in light of conclusions reached in respect to (above) capabilities and limitations of aids both in service and in development and to consider time scale of required implementation.

United States was unable to obtain the support necessary for acceptance of its proposal that the existing international VOR/DME standard be modified to include signal characteristics of Vortac's Tacan distance measuring equipment (DME-T). Proposal was defeated by a vote of 11-11 with seven countries abstaining.

United States objection to the British proposal for a meeting to evaluate area coverage versus rho-theta short range aids stems from its commitments for extensive implementation program of the CAA for the rho-theta Vortac system.

United States delegation appended two statements to the recommendations of the meeting, the first referring to its action on DME:

"The United States delegation does not accept the decision of the Sixth Communications Division meeting wherein the meeting declined to make needed amendments to the DME specifications. . . . The United States government therefore reserves the right to adopt or reject any course of action with respect to this matter on territories under its jurisdiction as it may deem appropriate to its national interest."

Second U. S. statement refers to the future special meeting to study navigation aids:

"The United States delegation has agreed to recommendation 3.3/10 regarding a 'special meeting' to study navigational aids. This action should not, however, be construed as a commitment that the United States government will be represented at such a meeting. The U. S. government reserves its position on this subject until it has had an opportunity to review the entire problem. Including such factors as the scope of the meeting's agenda the date on which it will be held, and others."

Farside Hits 4,000 mi. Altitude

Washington—At least one and probably two Air Force Farside balloon launched rockets are believed to have reached the 4,000 mi. target altitude in firings at Eniwetok Atoll.

Another reached an altitude almost as high as the orbit of the Soviet satellite on the day before the satellite was launched, but this information was withheld for three weeks, even though it might have helped offset the psychological impact made by Sputnik.

Details on the firings as learned by Aviation Week:

- **Shot One, Sept. 25—Balloon ripped and the missile was not launched.**
- **Shot Two, Oct. 3—Passage of the rocket through the balloon damaged the telemetry transmitter.**

Data was recorded to a little over 500 mi. altitude, but the rocket is believed to have gone higher. Pentagon had this information by the time Russia announced its satellite launching but did not release it and refused for several days to verify it after it was learned from other sources.

- **Shot Three, Oct. 7—Rockets had to be fired from below 70,000 ft.—desired altitude was 100,000 ft.—because of weather conditions. Some stages did not fire, but missile still did well. Transmitter gave data to an altitude above 400 mi. before quitting due to overheating.**
- **Shot Four, Oct. 11—Balloon material froze in low temperatures in the tropopause. Rocket was fired for safety reasons.**
- **Shot Five, Oct. 20—Apparently achieved 4,000 mi., based on visual observations of the burning period, but transmitter was not operating throughout.**

Radar was not used to track Farside because it is too small and moves too fast in vertical trajectory.

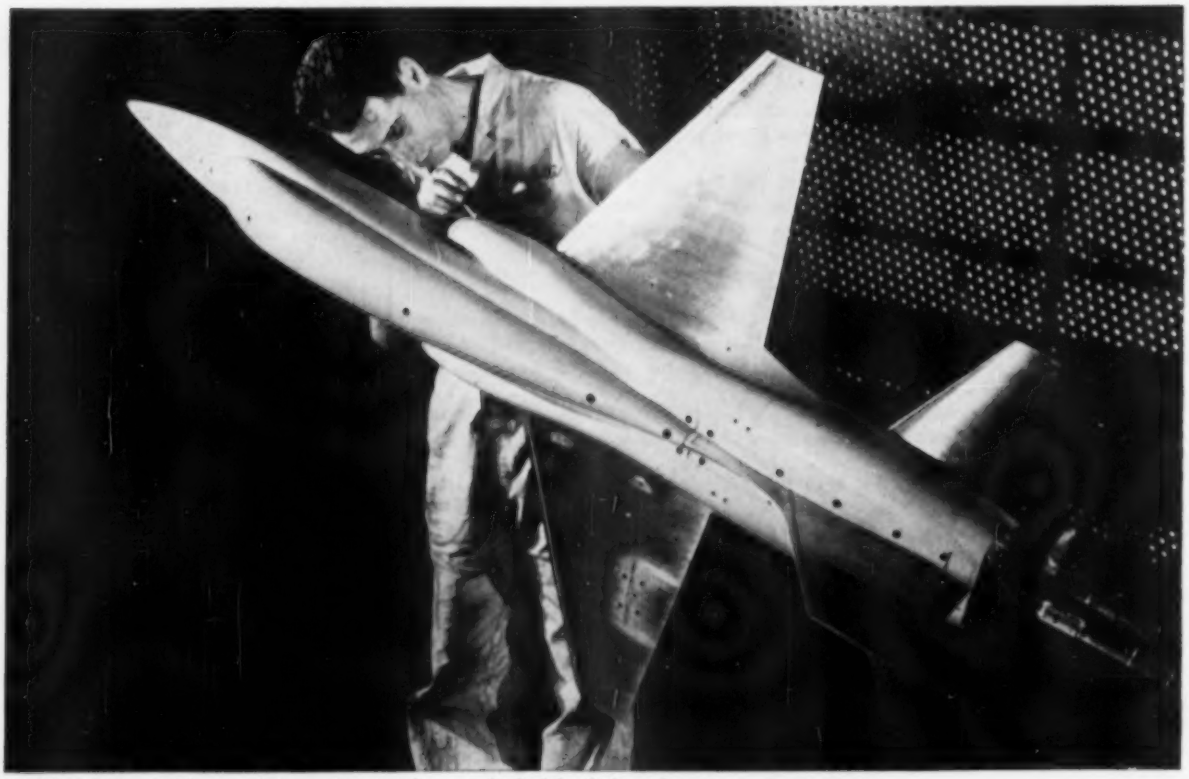
- **Shot Six, Oct. 22—Also may have achieved full 4,000 mi. Transmitter gave data to 1,000 mi. before giving out but observation of the burning period indicated rocket continued its path.**

When the complete data has been reduced more exact determination may be available.

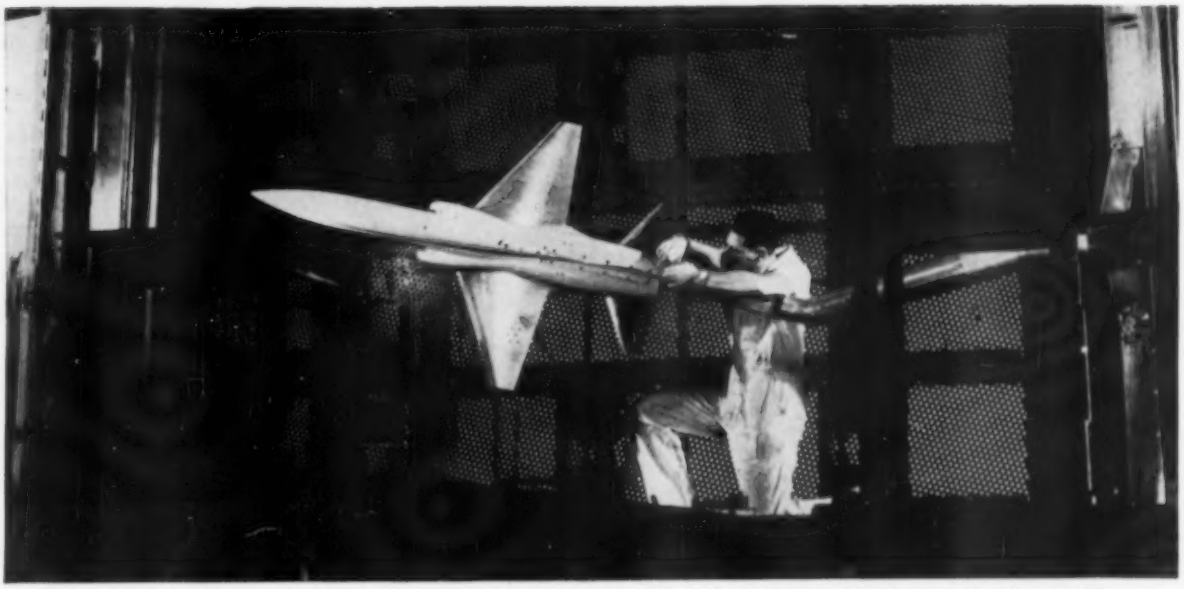
Future of Farside program will depend on availability of funds. Contractors say they will not carry it farther on another "shoestring" budget. Sponsor is Air Force Office of Scientific Research under Brig. Gen. H. F. Gregory. Dr. Morton H. Alperin, head of AFOSR's Directorate of Advanced Studies, directs the project. Prime Contractor is Aeronutronic Systems Inc., a Ford Motor Co. subsidiary. Project manager for Aeronutronic is Herbert Karsch.

Most of Farside group arrived at Eniwetok Sept. 23, and included team from General Mills Co., balloon contractor. Some returned Oct. 23. Aeronutronic team was headed by E. H. Krause, vice president for research and development. AFOSR team was headed by Dr. Alperin and, in later stages, by Col. Eugene Levier, new deputy for operations, who replaced Col. William O. Davis.

TECHNICIAN synchronizes the model's angle of yaw with the remote angle control system in the tunnel operating console.



PRESSURE tubes inside one of the engine air inlets are checked for leaks and response prior to a test.



FINAL adjustment is made to model's instrumentation. Perforated test section walls in the Cornell high speed tunnel are visible.

T-38 Model Shows Low Drag Wing Fairing

Northrop T-38 supersonic basic trainer, shown during wind tunnel tests at the Cornell Aeronautical Laboratory, has been area-ruled and considerable care was used in finding the optimum shape of the fairing for the wing root.

This fairing tends to compress the flow over the inboard portion of the wing trailing edge increasing the static pressure there and reducing drag. Most wing pressure drag orginates on the inboard sections and flow conditions around the wing root are important.

Tests Purpose

Main purpose of these particular tests was to determine the aircraft's stability characteristics from about Mach .85 to Mach 1.3. Current portion of the program being conducted at Cornell involves models which are structurally similar to the aircraft to investigate its aeroelastic characteristics.

Model shown here is supported by an adjustable sting which sets it at some fixed pitch angle with reference to the tunnel air stream. The yaw angle of the model can then be varied automatically while the tunnel is running. The resulting data outlines the aircraft's tendency to pitch, roll and yaw during maneuvers which combine yawing and pitching motion.

The T-38 will be powered by two small turbojets mounted in the box-like body of the empennage so that they can be serviced and removed with a minimum of aircraft disassembly. The horizontal tail has about 2 deg. of adhedral and is set low almost in the plane of the wing. It is a one-piece, all-moving type of control surface.

The wing is very thin varying from 5% thickness at the root to 3% at the tip.

Lateral control is effected by small-span, long-chord ailerons located well inboard.

Utilizes Fang Features

The T-38 utilizes many features of the Fang, a Northrop experimental fighter design. Speed and general characteristics of the T-38 would make its conversion to a light-weight fighter a relatively simple matter and this is one of Northrop's selling points.

Change-over to the fighter role would be accomplished by removing the rear seat and adding fuel tanks or electronic gear depending on the type of mission to be performed. Armament will be a part of the trainer equipment and there is space in the trainer for basic electronic navigating and weapon directing equipment. A heavier take-off weight can also be handled by the basic trainer airframe.

TECHNICIANS above check the surface condition of the model before a test run begins.

Holaday Speech Describes Shift To Solid Propellants for Missiles

Brigham City, Utah—"Large operational shift to solid propellants is now a reality," William M. Holaday, Special Assistant to the Secretary of Defense for Guided Missiles, said in a speech delivered for him here last week.

The speech, delivered for Holaday by Brig. Gen. Austin W. Betts at the opening of Thiokol's Chemical Corp.'s new solid propellant plant here, stated officially what AVIATION WEEK had reported earlier about solid fuels (Oct. 7, p. 50).

While in the past, most big rockets have been liquid fueled following German precedent with the V-2, the Holaday speech said the specific impulse advantage of liquids over solids has narrowed, while the solids have retained other advantages. They are, he said, of simple construction and need no fuel tanks, lines, valves, etc.; they avoid problems stemming from use of liquid oxygen which requires special handling and transporting equipment because of its low temperature and cannot be stored in the missile in readiness for firing. Liquid rockets also require a much longer count-down before firing to allow for fueling and checkout, while solids can have short count-down, can be kept ready for firing over prolonged periods and have a reputation for reliability.

Regarding growth in the solid propellant rocket field, it was pointed out there are now over a dozen companies in the business. Despite rapid growth in performance and variety of application for solid rockets, the Holaday speech said people in the industry report that they have not yet reached a size or performance limit.

A growing proportion of development cost to total expense for a missile produced in useful numbers demands that every advantage be taken of existing missile technology and that missiles should be designed for maximum flexibility of operational assignment so that costs can be reduced by making larger numbers of fewer designs.

Nike Ajax was developed for about 10% of total cost, but it is now possible for development cost to actually exceed production cost of a missile. Betts reported that missile development is proceeding at maximum speed.

New Thiokol Plant

The speech was made at a ceremony opening Thiokol's privately financed $3 million plant. The one static test stand now ready for use is capable of handling an engine 12 ft. in diameter and developing two million lb. thrust.

Pits for casting of propellant grains are also capable of handling 12 ft. diameter cases. In Thiokol rockets, liquid polymer propellant-binder bonds itself to clean metal case when cured.

It is chemically related to Thiokol's polysulfide synthetic rubber. Oxidizer is usually ammonium perchlorate. Boron hydrides are being studied but are not expected to appear except as additives in the near future. Thiokol claims a reliability record of 97.5% for its solid propellant rockets.

Firing Bay

Manufacturing, storage, testing and administrative facilities are scattered over an 11,000 acre site for safety. The big firing bay, called the largest horizontal thrust stand in the U. S., withstands two million lb. thrust with only .004-in. deflection. Small deflection for large thrust gives high natural frequency for accurate recording of thrust transients.

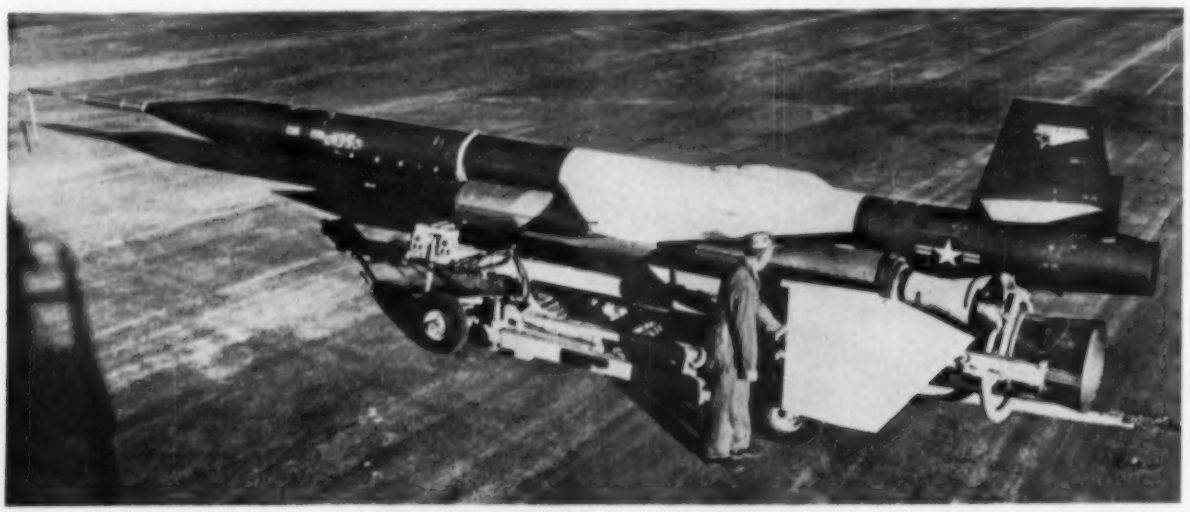
Electra Proposed For Anti-Sub Role

Washington—Economy measures have forced the Navy to review intended commitments for new antisubmarine warfare aircraft. Seaplane configuration apparently had been favored initially, but some elements in the Bureau of Aeronautics now favor pushing land-based ASW designs, and Lockheed is proposing a version of its Electra turboprop (AW Sept 16, p. 23).

Before the full impact of the current military economy drive was felt, Convair Division of General Dynamics Corp. had practically obtained the Navy's go ahead for its ASW Model 24 seaplane proposal, but the contract has not yet been awarded.

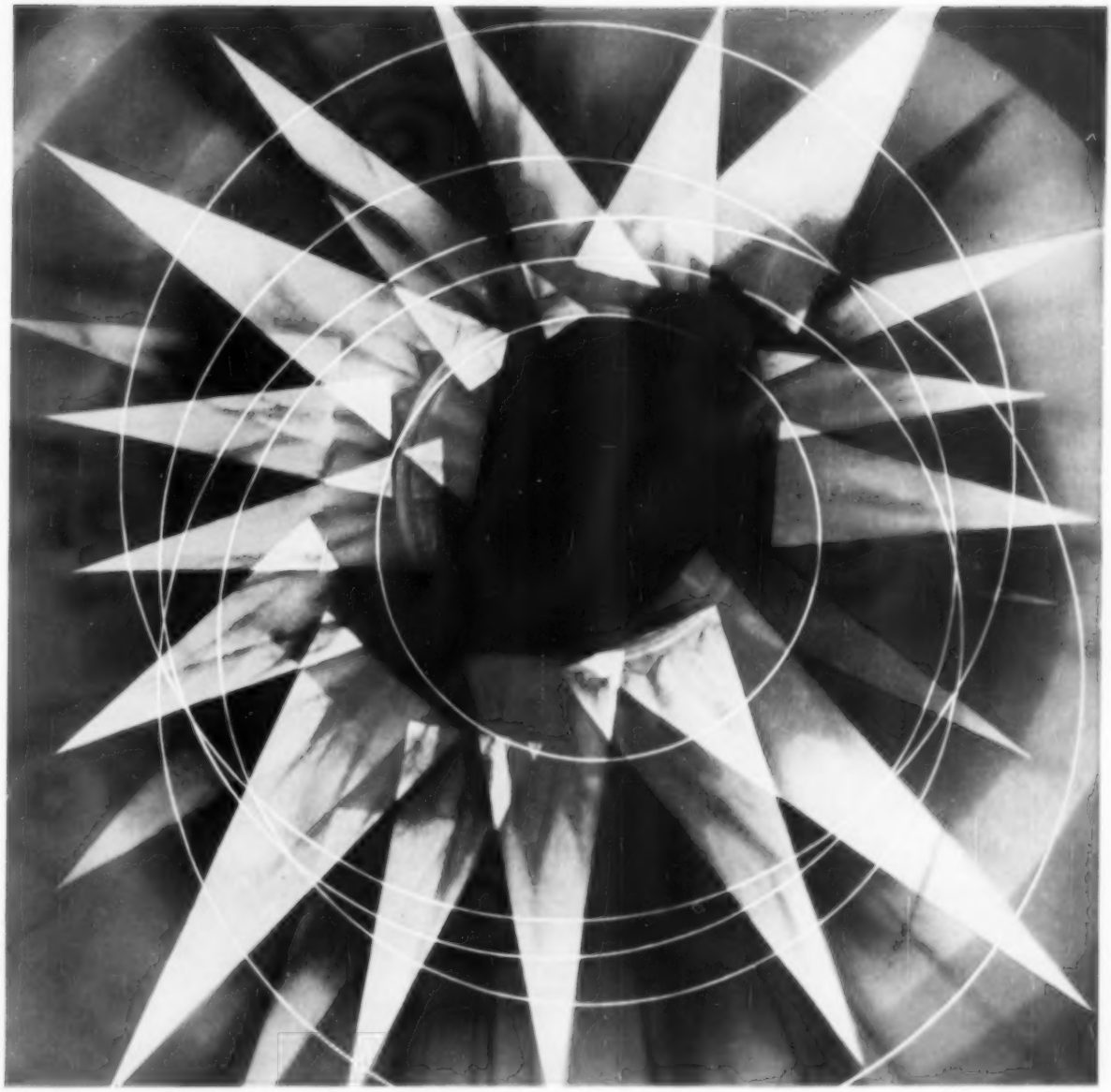
Now, Lockheed Aircraft Corp. has proposed to BuAer a version of its upcoming Electra turboprop-powered transport for ASW service, AVIATION WEEK has learned.

Convair design for its Model 24 ASW seaplane, as proposed to BuAer,



Supersonic Target Missile

Ramjet target vehicle, Lockheed's Q-5, resembles X-7, a supersonic vehicle used to test ramjet engines. Booster rockets have been added to Q-5; wing configuration differs from X-7. Like the X-7, target vehicle has parachute for recovery. Missile, instrumented to score near misses, theoretical hits, is being developed at Lockheed's Van Nuys, Calif., plant.



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with Utica Vacuum Metals

Today's challenge lies in developing *metals* and *means* of cracking the thermal barrier.

The metals problem has already been partially solved by superalloys produced through Vacuum Melting. This process, as developed by Utica, has yielded such super refractory alloys as Udimet 500—a clean, pure alloy combining unsurpassed stress-rupture life with superior high tensile strength in the 1200° F to 1800° F range. *At 1600° F, Udimet 500 has a tensile strength of over 100,000 PSI.*

In addition to making new superalloys, Utica Metals Division of Kelsey-Hayes upgrades existing alloys through vacuum melting. Kelsey-Hayes Co., Detroit 32, Michigan.

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- *Precise chemical control*
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- *Greater yield strength*
- *Greater impact resistance*
- *Greater creep properties*

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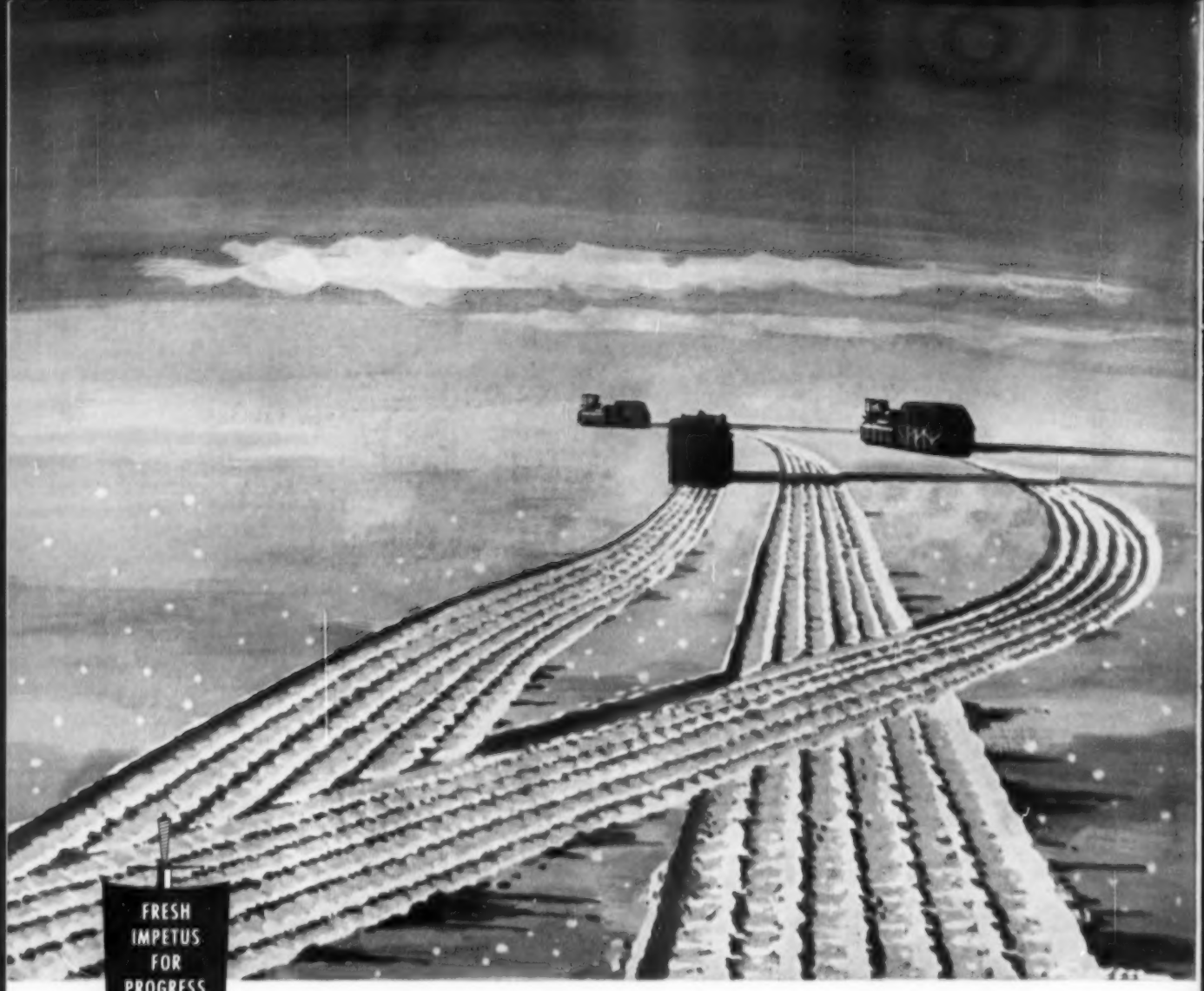

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highlights these specific features:

• **Configuration incorporates** high wing supporting three Wright Turbo-Compound engines. Center engine is higher than powerplants on either side so that propeller clears hull.

• **Plane is larger** than Lockheed's P2V. Cockpit accommodates pilot, co-pilot, navigator and controller (engineer). Hull accommodates about five other crew members.

• **Transparent observation blister** is located forward of the cockpit.

• **Aft of cockpit** is a ladder leading down to forward hull compartmentalized area on starboard side, accommodating some of the craft's avionic gear. Complete gear includes electronic counter-measure equipment, radar, radio, sonar and magnetic detector.

• **Consoles, buffet and bunks** are installed aft of the avionic compartment area.

• **Space directly beneath** hull top shell accommodates electrical gear. Area below the hull floor is vacant to avoid exposing equipment to corrosive sea water.

• **Fin sweeps forward** in long line. Underneath fin, magnetic detector gear is installed in hull boom which extends aft of rudder trailing edge.

Varig Airlines Orders Two Caravelle Jets

New York—Two Sud Aviation Caravelle jet transports have been ordered by Varig Airlines of Brazil at a cost of $5 million. Delivery of the first plane to Varig is scheduled for June, 1959.

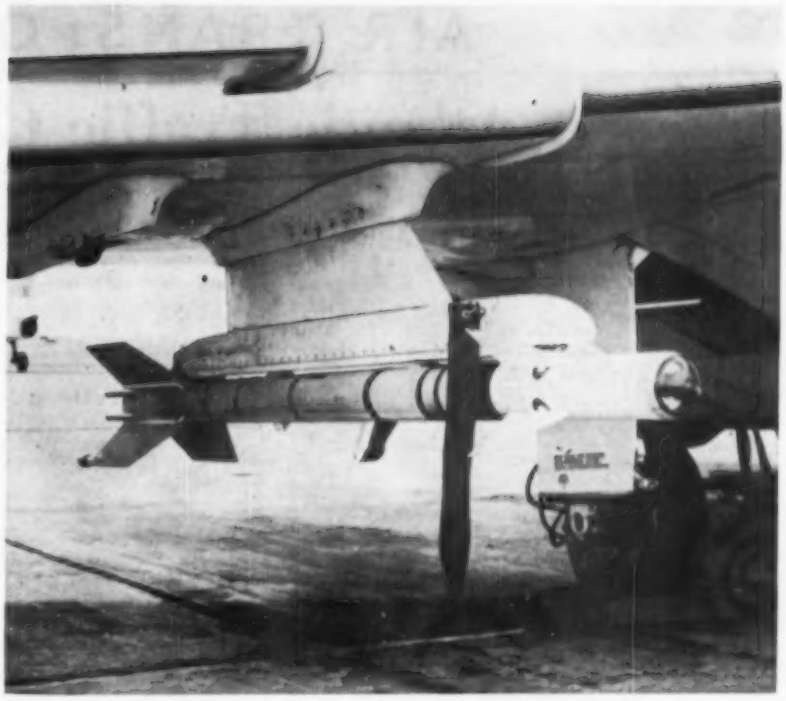
The order represents the first tangible result of Sud's North and South American sales tour last spring with the twin-jet aircraft. Varig may use the Caravelle on its route between New York and South America as an interim plane before delivery of Boeing 707s. The Caravelle then could service Varig's coastal route.

The Varig Caravelles will seat 64 passengers in first class accommodations. Flight time between New York and Rio de Janeiro is expected to be 11 hours, with two stops en route.

Employment Lag

Washington—Aircraft industry employment dropped 24,400 in the four months from April to August, preliminary Bureau of Labor Statistics figures for August show.

Defense cutbacks reduced jobs from the all-time 909,100 peak last April to 884,700 in August. Figure for July was 902,000 (AW Sept. 30, p. 33). Production employes declined from 585,000 in July to 574,600 in August, the preliminary total showed.



Sidewinder's Scanner Shown

Sidewinder, infrared-guided air-to-air missile now in operational use with Six and Seventh Fleets, is shown mounted under wing of Grumman F9F. Optical head (Irdome) and scanner are visible. Sidewinder is produced by General Electric's Light Military Electronic Equipment Dept. and Philco Corp.

News Digest

Russian Tu-104 will now be built in East Germany under Russian license, East German sources report.

Seven-member Swiss Air Defense delegation conferred with Douglas Aircraft Co. officials on proposed purchase of A4D Skyhawk bombers for Swiss Air Force. Group, headed by Gen. Etienne Primault, chief of the Swiss Air Force, was part of a Swiss purchasing mission to various U. S. aircraft manufacturers.

British Ministry of Supply Valiant was recently flown from Boscombe Down to Montreal and back, navigating solely on the Dectra systems between 10 deg. W and Gander, using European and Canadian Decca coverage for the remainder of the flight. Flight was made as part of North Atlantic trials of the system. Tracking and ranging patterns are now in operation. The tracking pattern being produced from two stations in Newfoundland, the ranging pattern being generated by synchronized transmissions from stations in Newfoundland and Scotland.

Pre-series production of 10 Mirage III supersonic interceptors began at Dassault's St. Cloud factories. Mirage is powered by Snecma Atar turbojet and SEPR rocket unit.

Russian government newspaper Izvestia charged that the United States dispatched several squadrons of jet bombers to Turkey that are capable of delivering the atomic bomb. Izvestia also asserted that large supplies of U. S. arms were being rushed to Turkey in preparation for an attack on Syria. Charges were made in support of the Soviet claim that the United States is plotting war against Syria through Turkey. Both the United States and Turkey have emphatically denied the accusations.

Development aircraft for the Comet 4 and 4B jet airliners, the Comet 3 G-ANLO, flew nonstop from Hatfield to Khartoum, establishing a new record of 5 hr. 51 mins. 14.8 secs. for the city center-to-city center distance of 3,064.1 statute mi. Record, subject to confirmation by the Federation Aeronautique Internationale, represents a speed of 523.4 mph. Comet 3 went to Khartoum for the first of a series of tropical trials during which its takeoff, climb and landing performance, at various weights, will be measured in temperatures ranging up to 100F and more.

Summer Atlantic Traffic Continues Gain

Tourist passengers total 369,000, accounting for most of record 21% June/September increase.

By Glenn Garrison

New York—Transatlantic airlines carried 459,500 passengers last summer on their scheduled North Atlantic flights, a 21% increase over the same June/September period of 1956.

After a slow beginning, the last peak season of the all-piston era on the Atlantic rolled up a total of 369,600 tourist and 89,900 first-class passengers.

Possibly because of the Suez crisis of last fall, eastbound traffic for the first few months of the year fell far below the carriers' expectations. But things began to pick up in April, and during the summer peak months prospects for an excellent 1957 grew brighter. Once under way, the season held strong through September.

Westbound Did Well

Westbound traffic, boosted by refugee and immigrant-fare passengers, was far ahead of eastbound business during the early months of the year.

Next summer the turboprop Bristol Britannia will be flying the Atlantic, and after that come the jets. Meanwhile, developments during the 1957 season included:

• **New aircraft** carrying summer traffic for the first time were the Douglas DC-7C and the Lockheed Super Star Constellation.

• **Two new fares,** the premium de luxe class and the reduced-rate 17-day excursion, were in on-season use for the first time. How much new business the excursion fare generated remained a moot question.

• **Shift to the mixed class** configuration continued during the summer. Flights with combined first class (including de luxe) and tourist accommodations increased 35%, while all first class flights decreased 25% and all-tourist flights were fewer by .0290%.

• **Seats available** during the four-month period totaled 643,800, up 15% from 1956. Overall load factor eastbound and westbound was about 71%.

Eastbound Dipped

January eastbound traffic totaled 19,259 passengers, up only slightly from 18,431 in January, 1956. February and March were equally disappointing, April registered a gain of about 4,000 passengers, and eastbound traffic in May totaled 43,613 passengers compared with 35,594 in May, 1956. The rush was on.

Total traffic in both directions for the first five months was 299,695, a gain of about 30% over 1956. But the westbound increase was about 54,000 passengers, while the eastbound total was up only about 14,000.

As usual, tourist class business accounted for almost all of the record June/September traffic rise in 1957. Tourist traffic increased about 24% over the 1956 summer total of 298,257 passengers, while the first class passenger total was up about 10% from 82,000 in 1956.

PASSENGERS deplane from KLM Royal Dutch Airlines DC-7C at Amsterdam.

The transatlantic carriers operated 10,085 scheduled passenger flights during the 1957 season, up from 9,251 in the same four months of 1956. Flights split 5,061 eastbound, 5,024 westbound.

Mixed flights for the first time edged out all-tourist flights with total of 5,100 mixed and 3,818 all-tourist operations during the summer. First class flights totaled 1,167. In summer 1956, totals were 3,791 mixed, 3,891 tourist and 1,569 all first class flights.

Of the total seats offered, 504,700 were tourist and 139,100 were first class. Eastbound seats, totaled 320,500 with a load factor of 64%. Westbound, seats totaled 323,300 and load factor was 77%. Passengers totals were 208,000 eastbound and 251,500 westbound.

Generally, reported results of the excursion fare seem to depend on the views each airline held when the compromise plan was adopted in 1956 by International Air Transport Association, and which were still being debated earlier this month at IATA's traffic conference in Miami (AW, Oct. 21, p. 39). Trans World Airlines for example, an original proponent of the plan, has found the fare "all in all, pretty helpful to business." About 7,200 roundtrip 17-day excursion fare tickets were sold by the airline between Oct. 15 of last year and Aug. 31, 1957.

Survey Needed

On the other hand, some other carriers agree with Trans-Canada Air Lines vice president-sales W. Gordon Wood, who reports that "the experience of TCA with the excursion fare for transatlantic travel has shown that the time is too short to provide the incentive needed to induce new travel."

Until somebody makes a survey, it will be difficult to determine just how much of the new business would have developed without the fare. One airline official suggested that business travelers might be using it on short trips to get the lower rates, thus cutting, not increasing, airline revenues.

In any event, the excursion fare is an interim measure pending agreement among the IATA members on some form of third class rate.

TWA figures for June, July and August show increases of 7.8%, 6.9% and 21.1% in transatlantic passenger traffic respectively for those months. Totals were 19,028 for June, 18,662 for July and 20,996 for August. First class business in June was off 4.2%

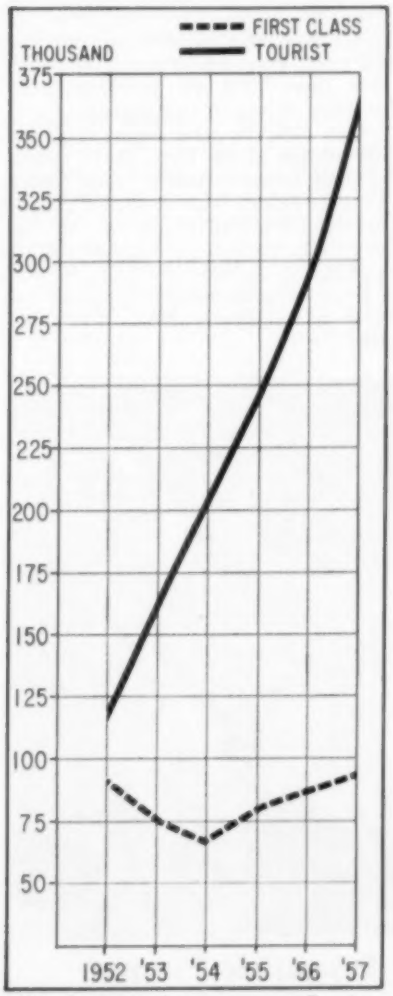
North Atlantic Scheduled Passengers June/Sept.,1957

	EASTBOUND			WESTBOUND		
	First	Tourist	Total	First	Tourist	Total
June	12,900	56,000	68,900	9,900	42,800	52,700
July	11,100	49,800	60,900	9,400	41,400	50,800
August	8,400	32,800	41,200	13,400	63,500	76,900
Sept	10,200	26,800	37,000	14,600	56,500	71,100
Total	42,600	165,400	208,000	47,300	204,200	251,500

from 1956, but increased 24.2% in July and 34.8% in August over those months of 1956.

Though a Port of New York Authority survey of transatlantic air travel showed relatively little use of the pay-later plan, the airlines generally speak well of its effect. TWA, for example, reports $10 million in pay-later sales since the plan went into effect in August, 1954.

In 1956, according to Trans World, it sold almost $4 million and in the first six months of this year sold about $1½ million.



RISE of tourist class summer traffic since 1952 is shown in graph of June/September results.

Trans World's big event on the North Atlantic last summer was introduction of its "Jetstream" long-range 1649s.

Pan American carried about 97,000 passengers during the four months, up from 86,700 in 1956. The carrier operated 834 mixed flights, 1,016 tourist flights and 634 first class flights, compared to 764 mixed, 1,134 tourist, and 628 first class flights in the summer of 1956. About 3% of Pan American's transatlantic passengers use pay-later, the airline reports.

Other Results

Some other individual results of the 1957 summer season:

• **Air France** carried 22,884 passengers, 10,500 of them eastbound and 12,384 westbound. Increases over 1956 were 28.6% and 28.4%, respectively. Best month was September, with 2,215 eastbound and 4,031 westbound passengers for a total of 6,246. The french carrier on Aug. 8 introduced its 1649 Constellation, calling it the "Super Starliner," and is now using it in both de luxe "Golden Parisienne" and mixed flights. Air France also offered new through services this summer between the United States, Europe and the Near East. Carrier attributes a large part of its traffic increase to "the enormous contribution of the travel agent."

• **British Overseas Airways Corp's** traffic totaled 40,218 passengers, up from 28,449 in summer 1956. First class passengers totaled 10,306, down slightly from 10,587 in 1956, but tourist passengers increased from 17,862 to 29,912. Monthly, BOAC's 1957 figures were June, 10,603; July, 10,084; August, 9,909, and September, 9,622.

De Luxe Flights Full

The airline's all-de luxe "Monarch" Stratocruiser flights consistently continue to draw high load factors, BOAC reports. Last summer BOAC was offering DC-7C service to Europe from the East Coast as well as from San Francisco, Chicago and Detroit. It plans to put Britannia 312s into transatlantic service next year.

• **El Al Israel Airlines** carried 3,760 passengers, up from 3,650 last year. El Al hopes to start Britannia service in December.

• **Swissair's** 1957 summer total was 14,808 passengers, up from 10,390. Breakdown was 11,155 tourist, 3,653 first class. Best month was June with 3,005 tourists, 946 first class passengers. Although in favor of increasing the excursion fare period to three weeks, Swissair reports it is selling well in the two-week version.

The Swiss carrier had DC-7Cs in operation during the summer.

• **TCA** carried 21,854 passengers, up 27% from its 1956 transatlantic total. Tourist total was 19,247, first class was 2,607. Best month was June with 6,020 passengers.

The airline is a strong adherent of pay-later. It says the plan has been a great financial success and has enabled many Canadians who normally wouldn't be able to fly to Europe to visit the continent.

National Strike Ends After 34 Day Period

Washington—National Airlines resumed scheduled operations Thursday after signing a working agreement with the Air Lines Agents Assn., to end a 34 day period of suspended operations.

Approximately 3,000 employes were furloughed when the airline brought operations to halt on Sept. 22 following a series of walkouts by the agents. The union had claimed that "the agent and clerical employes of National . . . never have been on strike . . ." and accused the airline of "locking-out" employes in an effort to "weaken or break organized labor on the airline."

Schedules to all points on the company's system were expected to have been restored by yesterday. First flights to go back into operation serve New York, Washington and Miami.

Agreement reached Tuesday by National and the Air Line Agents Assn. covered the following points:

• **Current wages** are to be arbitrated.

• **Terms of the agreement** are for three years with provisions for wage adjustments after the first and second years and arbitration of wages if negotiations fail.

• **Probationary period** for new employes can be six months instead of three months at supervisor's discretion.

• **Part-time employes** can be used to relieve excessive workload.

• **Modified union shop** agreement will be continued.

National said that, with resumption of service, it will require approximately 550 additional employes, including pilots, flight engineers, stewardesses, mechanics, operations and reservations agents.

Popularity of Centerline System Established in Air Force Tests

By L. L. Doty

Washington—Recent Air Force evaluation tests of airport approach lighting configurations have reaffirmed the centerline approach system as the configuration most likely to be endorsed by all airport users as a national standard.

In a series of tests conducted by the 15th Air Force at March AFB, Calif., popularity of the centerline system among both military and civil pilots was firmly established (AW Sept. 9, p. 119). The system, including stroboscopic flashers and flush units within the underrun area, already has the backing of the Civil Aeronautics Administration, Air Transport Assn. and the Air Line Pilots Assn.

Primary purpose of the tests was to evaluate a lighting system that would facilitate landings of high performance aircraft under restricted visibility conditions. Fixtures installed at March included USAF airfield lighting equipment, Sylvania Stroboscopic Condenser Discharge Lights and the Elfaka Flush Lighting units. Arrangement of fixtures was a composite of several approach lighting systems connected with a remote switching unit to permit a change from one lighting pattern to another.

USAF Plan

The centerline configuration recommended by the Air Force group as a basic requirement for a national standard calls for Elfaka flushlights with green filters at the runway threshold.

For 1,000 ft. out from the threshold in the overrun area, a total of seven centerline bars, each with four flush lights and one flush Strobeacon, were located at intervals of 700 ft. At 1,000 ft. from the threshold in the approach area, two cross bars with 10 lights each were installed. Beyond this point, 20 elevated centerline bars with five lights each were located at space intervals of 100 ft. Each centerline bar also included an elevated Strobeacon to form a complete centerline system with stroboscopic flashers 3,000 ft. from the runway.

In analyzing the results, the Air Force learned that the Strobeacon light could be seen at a distance of about three times the reported visibility. For example, under one-half mile visibility conditions, pilots were able to detect the lights one and one-half miles from the runway or one mile from the beginning of the centerline system.

Pilots also reported that the centerline lights were visible when aircraft were as far to one side as the GCA wave-off point. It also was noted that, although the 30,000 candlepower Strobeacon lights are not blinding, they are distracting to a pilot unfamiliar with their use. However, any hazard is eliminated once a pilot is conditioned to the use of the lights.

Navy Reaction

Naval pilots participating in the tests indicated the centerline system was adequate.

The Air Force group said that, once flush-mounted lights are installed in the runway landing area in conjunction with the centerline approach lighting system, a safe zero-zero capability would exist for most aircraft.

The centerline system was evaluated with white roll guidance bars together with a red configuration. Generally, it was agreed that the guidance bars contributed to pilot confidence, but that they were useless as an aid in making the transition to visual flying during roundout and touchdown.

For runways other than the instrument runway, the Air Force group suggested the use of a flush termination bar and elevated red wing bars in addition to the threshold lights. It also proposed the installation of narrow gauge runway lights to permit further evaluation of visual aids for flare-out and landing, although the CAA conducted a series of such tests with runway lights at Andrews AFB near Washington earlier this year (AW April 15, p. 99).

The group also recommended that the counterpoise wire be buried in the ground rather than in a duct in order to cut both installation and maintenance costs.

It urged a redesigning of filters to eliminate possible clogging of the drainage system in sandy regions.

Centerline Cost

Funds required for the original centerline approach lighting system with stroboscopic flashers and flush units within the 1,000 ft. overrun sector amounted to $84,196. Of this amount, $27,820 was used for materials, $33,068 for labor and $23,308 for contingencies.

Equipment was installed with "little difficulty" and the "test installation required very little maintenance," according to the group's final report. It added that there were no problems with switches, wiring or transformers.

One difficulty arose during the testing because of the high rate of failure of lamps located within the flush Elfaka fixtures. Solder used between the light base and the lead energizing the filament was found to be too soft. With a change in the type of solder, the percentage of lamp failures dropped from 17% to less than one-half of one per cent.

Los Angeles Airport Expansion Planned

Architect's drawing represents an aerial view of Los Angeles International Airport after expansion construction is completed. Work is expected to begin in the first quarter of 1958. Parking lot (center) is surrounded by ticketing buildings.

New Bilateral Spurs Mexican Economy

Mexico City—Signing of U.S.-Mexico bilateral agreement has touched off the biggest year in Mexican aviation history, bringing in badly-needed tourist dollars to bolster the country's sagging economy.

Under terms of the air agreement signed last March (AW March 18, p. 45), there will soon be 3,000 new seats a week on international carriers to bring tourists into Mexico City.

Tourism has become one of Mexico's biggest industries. Last year, 519,904 tourists spent nearly $488 million, including the border trade. This averaged out to $40.7 million a month. This year, tourist and border trade receipts are expected to average $44 million a month, thanks largely to increased international air activity.

These extra dollars are coming at a time when Mexico's agricultural and mineral exports are down. Tourism is also a business, in which gross receipts are mostly profit since what Mexico sells is climate and scenery.

Tourist Boom

Moreover, tourism has given rise to a hotel building boom, particularly in Mexico City and Acapulco. More than 1,000 hotel rooms were added in Mexico City last year; another 1,000 will be added before the end of the year. At least three more hotels are rising in Acapulco, which before the end of next year will add another 500 luxury rooms to its capacity.

Meanwhile, all international carriers are preparing for heavy tourist promotion programs that will bring Mexico even more dollars.

Eastern Airlines, now offering first class, nonstop service to New Orleans and New York, plans to promote Mexico in all 127 cities it serves. Eastern, flying DC-7Bs on both routes, has been running a load factor of approximately 50% on both its nonstops.

Eastern vs. Air France

Thus far, Eastern has not been a major problem to Air France, which had enjoyed a monopoly on the New York nonstop route for several years.

Air France, using Lockheed 1649 Super Starliners, says its planes still carry a full load of 28 first-class, 34 tourist passengers. But it admits that, before Eastern's competition, Air France usually was booked months ahead. Flight reservations are now much easier for passengers to book.

The relative ease with which Eastern has cut into Air France's bookings may spell trouble for Air France. Although New York-Mexico City traffic is expected to increase, there does not now appear to be business for more than two airlines.

Where does that leave the Mexican carrier, Aeronaves de Mexico?

The Mexican government, which helped finance Aeronaves' purchase of two Bristol Britannias, is not going to permit Air France to seriously interfere with Aeronaves' chances of making the route a commercially successful one. Unless the flow of traffic is heavy enough for three airlines, Air France's present daily frequency might be reduced. And, if that isn't sufficient, Air France might be permitted to only book through passengers to Europe.

Only If Necessary

These protective steps will be taken only if necessary, however. It is believed that ex-President Miguel Aleman, controlling stockholder in Aeronaves, would like to extend the New York route to Europe. And the Mexican government knows that, in that case, Air France could be a valuable ally.

Aeronaves had hoped to inaugurate service to New York in November, with Bristol Britannia turboprop transports but it now appears that Dec. 15 will be the earliest possible date.

The first Britannia is to be delivered early next month with the second to follow three weeks later. Aeronaves' Britannias will offer mixed service to New York with 66 tourist seats, 28 first class.

Aeronaves also shares non-stop rights with Eastern to New Orleans. To reduce competition here, Aeronaves will offer only tourist service to New Orleans as opposed to Eastern's purely first-class service.

Electra Order

Aeronaves plans to purchase three Constellation 749s from Air India for use on the New Orleans run. Lockheed has been acting as intermediary in the transaction in exchange for Aeronaves' agreement to purchase three Electra turboprop transports for 1960 delivery and an option on four more. Aeronaves also would use the Electra's on the New Orleans route.

It does not now appear that Aeronaves will be able to inaugurate New Orleans service before early next year.

Compania Mexicana de Aviacion is doing well with its flights to Los Angeles and to Cuba and inaugurated nonstop service to Chicago on Oct. 15.

In Los Angeles, Mexicana shares the route with Western Air Lines. Western has been operating with a 45% to 55% load factor and reportedly has not been quite breaking even on the route. Moreover, even if it were to operate with a 100% load factor, it is unlikely that Western can make the route financially worthwhile unless it decides to put in more than one flight a day.

Western hopes to begin another flight next year, and it would be awkward for CMA to object since it takes two tourist flights into Los Angeles in addition to its first-class DC-7C service.

Chicago Nonstop

Mexicana will share the Chicago nonstop with American Airlines. The Mexican carrier, nearly 42% owned by Pan American, will be facing a tougher fight here than in Los Angeles.

American hopes to begin its Chicago nonstop service early in November, contingent upon clearance from the Mexican government. Meanwhile, American has offered its Monterrey airport for sale and, the Mexican government is reportedly interested in buying it. American has cut out its Monterrey stop en route to San Antonio, and this service has been taken over by Mexicana, also under terms of the new bilateral agreement.

Aerovias Guest, which halted its Windsor, Canada, service shortly after it reluctantly gave up the Chicago designation, plans to extend its Panama flight to Caracas and to revive its European run.

Expecting Clearance

Guest has been expecting clearance from the Venezuelan government and says it can begin service a few weeks after it receives the provisional permit. The permit would be provisional because no bilateral agreement exists between Mexico and Venezuela.

Guest is negotiating with several sources in the United States for equipment it needs to operate its European service.

It hopes to have settled the equipment problem by the end of November and that it can inaugurate service to Europe before the end of March to take advantage of Europe's big season.

Sinclair Buys Gulfstream

Sinclair Refining Co., Tulsa, Okla., was revealed last week as first purchaser of Grumman's turboprop Gulfstream business plane. Sale was arranged by Pacific Airmotive, one of three distributors appointed by Grumman for the Rolls-Royce Dart powered aircraft. Distributors have accepted deposits from other purchasers as well (AW Sept. 30, p. 29).

National Gets Recommendation For Dallas-to-West Coast Route

Washington—National Airlines has been recommended to provide air service between Dallas and the West Coast, a route unconnected with its present route system.

The unusual recommendation was made by Civil Aeronautics Board's Bureau of Air Operations Counsel V. Rock Grundman in a brief to Examiner Thomas L. Wrenn in the Dallas to the West Service case. Grundman favored National over six other airlines, including a supplemental carrier, to compete against American Airlines, which now provides service between Dallas and the West Coast.

Of the six scheduled airline applicants, a Dallas-West Coast route could become a part of the regular systems of Delta, Braniff, Continental and Western. Between Houston—the western terminal of National and Eastern, the other scheduled applicant—and Dallas, there is a 241-mi. gap. The supplemental carrier that applied for the route is California Eastern Aviation.

Proposed Route

The route described by the bureau council is between the co-terminal points of Dallas and Fort Worth, the intermediate points Lubbock, Albuquerque, El Paso and Phoenix, and beyond Phoenix to the co-terminal points San Francisco-Oakland, and another segment beyond Phoenix to the terminal point Los Angeles.

Grundman said the 241-mi. gap between the routes might increase National's cost of operations from Dallas to the West Coast but that it still could be operated with a profit to National. He said National proposes to contract with other carriers at Dallas or the West Coast for its periodic equipment checks and to ferry the aircraft back to Houston and route them to Miami for major and engine overhauls.

If National were to be certificated, Grundman said, it is possible that arrangements could be made that would eliminate all ferry mileage. He suggested that Delta and National might make arrangements of interchange service between Miami and the West Coast which would permit National to route its equipment to the Miami base on revenue flights.

At present, National, Delta and American operate through service under an interchange agreement to the West Coast, but Grundman said that, if either Delta or National was selected, the chosen line would be reluctant to continue as a partner to an interchange that was competitive to its own service.

Grundman said the bureau is convinced that the route would strengthen National and provide Dallas with improved service but, because of other factors involved, he recommended the authorization be on a temporary basis.

One reason, he said, is that the service recommended terminates at Dallas and will be operated in competition with American, the strongest of the domestic carriers which is already entrenched in the market and operates with the benefit of the back-up traffic from its transcontinental route to the Northeast.

Strong Competition

American also is a partner in interchanges that permit it to control a substantial portion of the traffic flowing to the west through Texas points from the South and East. There is a question, Grundman said, as to whether a carrier terminating at Dallas and operating without the support of through service and back-up traffic to and from points beyond Dallas can provide enough schedules to be an effective competitor.

As a result, Grundman recommended that the Board issue a temporary certificate and thus be in a position to provide effective competition by other means should it later appear desirable.

Grundman hinted at the possible establishment of a fifth transcontinental route in his recommendation that the termination of National's authorization be tied with the decision in any proceeding dealing with service between points on the East Coast and West Coast via Texas points.

"There are applications pending involving such issues," Grundman said. "At some time in the future, these applications will be reached on the Board's calendar, and at such time it is desirable that the Board have retained freedom of action to permit the authorization of through services should it then appear that such services are more desirable for the provision of effective competition or for other reasons."

Why National

If National is approved by the Board for Dallas-West Coast service it would place the airline in a better position for consideration as a fifth transcontinental carrier by merely closing the 241-mile gap in the route.

Grundman said the selection of National was based on the fact that the airline's record indicates it could provide effective service in the face of stern competition. As a small carrier authorized to offer a New York-Miami service in competition with Eastern, the counsel said National has proved to be an effective competitor and has offered a service designed to meet the needs of the public. He said National has been among the first in the utilization of new equipment and services and was the first carrier to propose daylight coach service, to promote the tourist-package deal and the adoption of the "red-carpet" treatment of passengers.

He said, however, that National is in need of additional route mileage not affected by seasonal problems such as the New York-Miami route. He added that much of National's traffic has been exposed to diversion by additional competition.

Comet Indemnity

Paris—Air France has accepted the payment of an indemnity from de Havilland Aircraft Co. that reduces the French carrier's loss on three early-type Comet jet transports to about $1,570,000.

Air France returned the three Comets to de Havilland in 1954 when the jets lost their certificates of airworthiness as a result of a series of accidents. At that time, Air France put in a claim for compensation.

Exact amount of indemnity paid is not known, although the three airplanes were purchased for approximately $5.6 million. The aircraft have since been overhauled and sold to the British Ministry of Supply.

Examiner Approves Permit for Qantas

Washington—Civil Aeronautics Board Examiner Richard A. Walsh recommended last week that a foreign air carrier permit be issued to Qantas Empire Airways of Australia, authorizing service across the U. S. and around the world.

The permit recommended by the examiner is pursuant to terms of the U. S.-Australian bilateral air agreement concluded earlier this year. It will authorize extension of Qantas' route to San Francisco across the U. S. to New York and beyond to London and Australia.

Although Qantas said the primary purpose of the route is to serve the Australia-United Kingdom market through the U. S., it asked that it be authorized to overfly London on some flights. The airline said the provision would not change the basic economics of the route nor would it change Qantas' obligation to comply with the capacity provisions of the bilateral agreement.

Pan American Renews Great Circle Bid

Washington—Pan American World Airways and four major West Coast cities asked the Civil Aeronautics Board last week to deny Northwest Airlines' bid for reconsideration in the twice reopened transpacific certificate renewal case.

At the same time, they asked that Pan American be granted immediate traffic rights at Portland and Seattle on the Great Circle Route to the Orient. The four cities are San Francisco, Los Angeles, Seattle and Portland. The statements, filed with the CAB, had the backing of Governors Robert D. Holmes of Oregon and Albert D. Rosellini of Washington.

The statements were filed in answer to an earlier petition by Northwest which asked the CAB to reaffirm its recommendations to the President which would deny Pan American traffic rights at the two cities (AW Oct. 14, p. 40). The recommendation was approved by the President on Aug. 2, but, on Sept. 3, he reversed his action and asked to hold the decision in abeyance.

Traffic Increase?

In changing his decision, the President cited the possibility that there may have been substantial recent increases in Seattle-Tokyo traffic. He also said Northwest's receipt of a permanent certificate on the "inside route" to the Orient through Minneapolis, Edmonton, Canada, and Alaska, may divert flights from the cities of Portland and Seattle.

Northwest denied there has been any significant change in U.S.-Orient traffic and charged that the White House ignored the CAB in favor of Pan American. The airline said President Eisenhower has overruled the CAB Pacific air route recommendations on five occasions since December, 1954, each time to the benefit of Pan American.

Pan American, in its answer to Northwest, said the airline is seeking to prevent President Eisenhower from exercising his basic rights to determine what airline should fly where, by instituting delaying tactics before the CAB.

Pan American Rebuttal

"A good deal of Northwest's petition," Pan American said, "is devoted to pleas that the Board, instead of transmitting to the President what he asked for, namely, the statistics of traffic between the U.S. and Tokyo, should bury these under an avalanche of irrelevant and immaterial matter relating to the traffic that Pan American carries in competition with United between California and Hawaii in competition with the Australian airline Qantas to the South Pacific, and, indeed, to its traffic in still other parts of the world.

"Of course, the reason why Northwest seeks thus to conceal the traffic statistics between the U.S., Tokyo and the Orient for which the President asked is because the latter are so compelling."

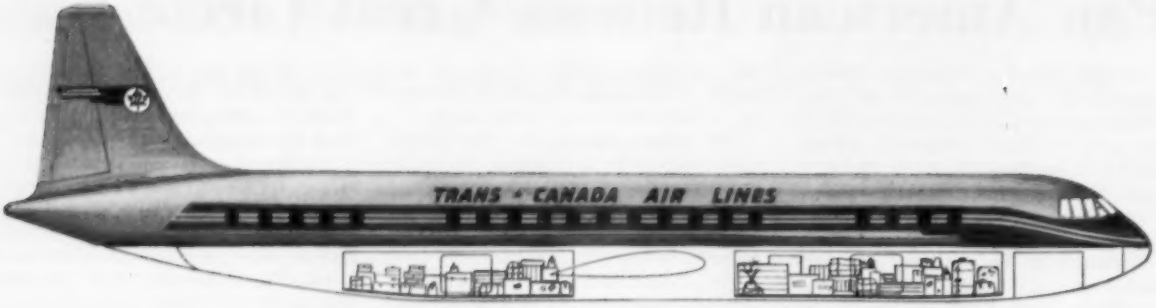
Pan American said that, in two and one-half years, the U.S.-Tokyo-Orient traffic of the two carriers has increased nearly 100%, and that Northwest's traffic has increased by 140%, far more than Pan American's.

Northwest said its percentage increase is higher than Pan American since it carried fewer passengers to begin with, but that Pan American's actual increase was greater than Northwest's.

Pan American also said legislation that made Northwest's "inside route"

Caravelle Maneuvers a Tight Turn

Caravelle airframe is transported through the streets of Toulouse, France, from plant en route to Toulouse Aeronautical Establishment. Wings and turbojet powerplants will also be trucked to the establishment where the complete craft will undergo static tests. Trip took three hours, covered six miles.



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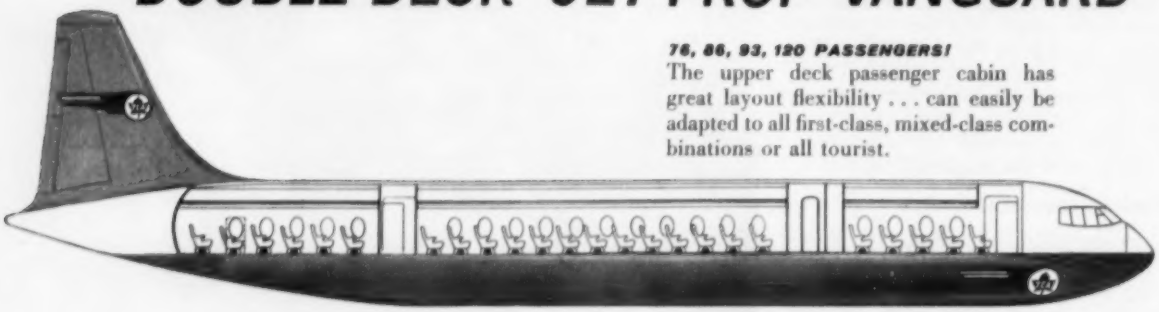

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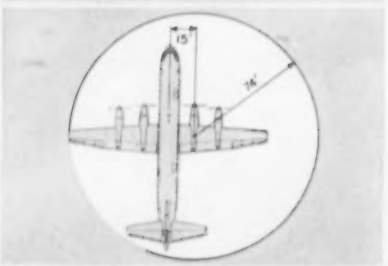
The upper deck passenger cabin has great layout flexibility . . . can easily be adapted to all first-class, mixed-class combinations or all tourist.



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The Vanguard was designed to reduce time on the ground—allow *more time in the air!* Thanks to separate 5′ 6″-wide cargo hold doors and plenty of working space, freight can be loaded and unloaded simultaneously—and in record time. And, to speed passenger handling, there are two passenger doors—each with built-in folding stairs. Finally, the Vanguard has outstanding ground maneuverability—a minimal turning circle and good visibility—permitting faster, safer movement on crowded ramps.

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to the Orient permanent has given Northwest an even shorter permanent route to Tokyo and added three more terminals–New York, Chicago and Minneapolis–on a permanent basis as compared with Pan American with two terminals and a mileage handicap exceeding 1,000 mi.

Pan American referred to the President's letter to the CAB when he first approved the recommendations in which he said: "It is this administration's objective, wherever traffic justifies it, to provide competitive U. S. service on all international and overseas routes from all gateways." To enable him to determine whether the traffic would justify such competitive service from Portland and Seattle, the President requested the CAB to review U. S.-Orient traffic periodically and report to him.

Pan American asked the Board to promptly transmit to the President the Board's latest statistics of traffic on the U. S.-Tokyo route as requested by the President when he asked that a decision on Pan American's bid be held in abeyance.

Northwest Petition

Northwest also referred to the President's letter in its petition for reconsideration. "A sound, balanced, competitive transpacific route structure requires that the President's decision on Aug. 2 be reaffirmed immediately," the airline said. "And the Board, as the primary advisor to the President on international air route matters, should make this firm recommendation."

"Lacking this, elementary fair play and justice demand that the Board withhold from Pan American the new 5,700-mi. California-Tokyo route awarded in the decision of Aug. 2, and reopen the entire proceeding, not only with reference to traffic rights at Portland and Seattle, but with respect to the entire Pacific route structure, including Northwest's applications which have previously been excluded from the case."

House Group Pushes Investigation of CAB

Washington–The special Commerce subcommittee headed by Rep. Morgan Moulder (D.-Mo.) is moving forward with its "Iron-Curtain" investigation of the Civil Aeronautics Board, now that the Board has backtracked almost 100% and has agreed to give staff investigators free access to its files (AW Oct. 14, p. 41).

On one point, however, CAB refused to budge. The personal memoranda of members, it says, will remain classified.

"Once a congressional committee has, by compulsion, probed the personal thought processes of the members of an 'independent' agency, the independence of judgment is destroyed forever," CAB Chairman James R. Durfee said. "Once this independence is gone, the integrity of judgment is lost forever." Durfee added that, if the subcommittee should want to inquire of any Board members "as to whether he was influenced by any ulterior or improper considerations in arriving at his own decision on a case, the member concerned is certainly ready to answer such inquiries freely and fully."

CAB has agreed to open these nonpublic files to the subcommittee staff, leaving to the subcommittee the judgment as to what information should be publicly disclosed:

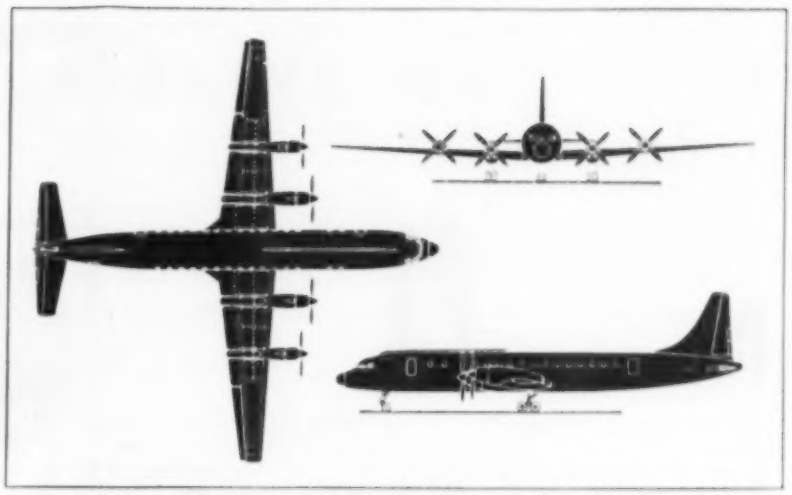
- **Staff memoranda,** including memoranda between the staff and Board members.
- **Communications** between the Board and the White House. Durfee reported that this would be done since the White House had informed the Board it has no objection.
- **Communications** with other governmental agencies and members of Congress after clearance by the source of the communication. If this clearance is denied, Durfee said the CAB would bow to the judgment of the subcommittee as to whether it wanted to review the communication anyway.

The subcommittee has not yet asked the Board for access to top secret communications involving national defense and international matters. The group has left pending a decision as to whether it would press further for access to members' personal files.

The Moulder group was established under the sponsorship of House Speaker Sam Rayburn (D.-Tex.) to look into possible White House domination of all of the quasi-judicial regulatory agencies.

The subcommittee's first interest is in the North Atlantic and Great Circle route cases. The North Atlantic case, involving the $17 million sale of American Overseas Airline, an American Airlines subsidiary, to Pan American World Airways, was decided in 1950 under the Truman administration. The Great Circle case, involving the Pacific area routes of Pan American and Northwest Airlines, has been in process since 1954 under the Eisenhower administration.

Antagonism has developed between Durfee and Subcommittee Counsel Dr. Bernard Schwartz, former New York University law professor. At a subcommittee session, Durfee charged that Schwartz had addressed him with such questions as: "What are you trying to hide?" "What are you covering up?" "What are you afraid of?"



Russian Turboprop Transport

Three-view of the Ilyushin-18 Moscow, new Russian turboprop transport, shows a resemblance to Douglas designs. It is slightly larger than the Lockheed Electra.

Airline Reorganizes Coordinating Council

New York–Trans World Airlines has reorganized its planning and coordination function following the resignation of John L. Weller, the airline's former vice president of planning and coordination.

Under the new setup, President Carter L. Burgess, senior vice presidents, the vice presidents of operations and of passenger service and the general counsel will compose an executive planning council to form, implement and audit TWA's plans and programs.

Another group under the senior vice president, sales, has been formed for integrated sales marketing and planning.

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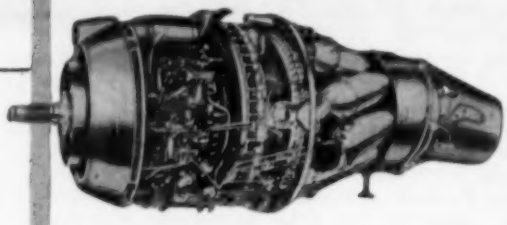

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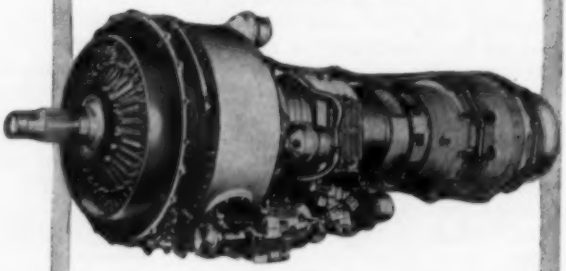
PROP-JET

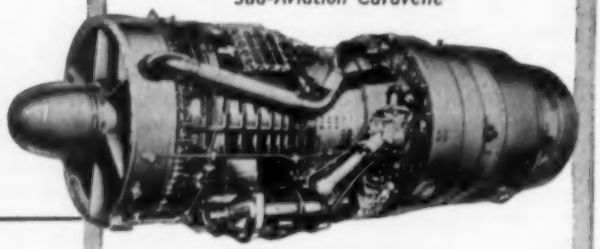
Vickers Vanguard
Armstrong Whitworth 651



AVON

TURBO JET

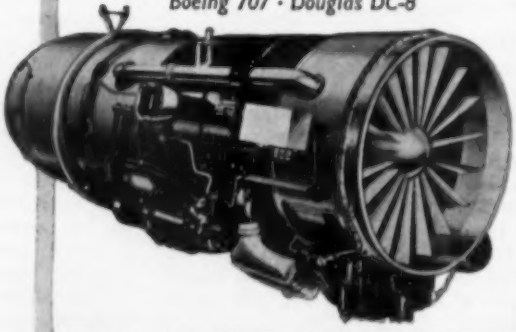
de Havilland Comet
Sud-Aviation Caravelle



CONWAY

BY-PASS TURBO JET

Boeing 707 · Douglas DC-8



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SHORTLINES

▶ **Iberia, Air Lines of Spain** has doubled its African service for Madrid to Spanish Guinea using Douglas DC-4 equipment. Two weekly flights to Bata, Spanish Guinea, via Valencia with a fuel stop at Niamey, French Cameroons, now operate out of Madrid. Iberia is now operating on its winter schedules.

▶ **Seaboard and Western Airlines** flew 7,957,433 ton-miles in scheduled air freight service during the first nine months of 1957, an increase of 35% over the same period of last year. The airline predicts it will pass the 12 million ton-mile mark by the end of the year.

▶ **British Overseas Airways Corp.** will begin daily first class Douglas DC-7C service from New York to Nassau on Nov. 30; daily tourist class Vickers Viscount service from New York to Nassau, Montego Bay and Kingston on Dec. 18; daily first class Viscount service from Miami to Montego Bay and Kingston on Dec. 18; three flights weekly from New York to Montego Bay and Kingston in first class configuration on Nov. 30. BOAC reports that the specially fitted Douglas DC-7C that carried Queen Elizabeth and the Duke of Edinburgh to Ottawa from London made a routine scheduled round trip on BOAC service between New York and San Francisco while the Royal family was on tour. The plane also was to be used for the return trip.

▶ **Civil Aeronautics Administration** has published a booklet outlining procedures and phraseologies used in radar air traffic control. The booklet, "United States Manual of Radar Air Traffic Control Procedures," is designed to standardize radar control by personnel of the CAA, Army, Air Force and Coast Guard. It covers methods by which radar control may be used by controllers, radar separation standards, radar identification, radar approaches and departures and other conditions where radar is applicable. The booklet is available at the U.S. Government Printing Office, Washington.

▶ **Pan American World Airways** has added six additional European cities to its all-cargo service. On Tuesdays through Sundays when the airline has between 220 and 2,646 lb. of cargo booked for Brussels, Amsterdam, Dusseldorf, Stuttgart, Munich or Berlin, its all-cargo aircraft will land at those cities as well as at the regularly scheduled stops of Shannon, London and Frankfurt.

AIRLINE OBSERVER

▶ Passenger traffic continued to climb during September, with the airline industry in general showing about a 10% improvement in revenue passenger-miles and a slightly smaller increase in the number of passengers carried as compared to the previous September. Airlines, however, complained that the increase fell short of forecasts and expressed concern that the rate of increase during the year has not been sufficiently large to absorb the steady climb of available seat-miles. Also, the normal decline of traffic in September from August was more marked than usual this year and the trend is continuing into October. A sharp dip in the volume of military traffic (AW Sept. 30, p. 47) and business travel has become evident to sales officials.

▶ **Northwest Airlines will concentrate on its international route requirements before considering domestic needs when it makes a final decision on its jet transport program. The carrier had hoped to find a jet aircraft that would be interchangeable on both route segments but is now resigned to two different type planes to handle its overall jet requirements and probably will settle on the Boeing 707 and the Convair 880. Northwest is now seeking adequate financial arrangements to back its jet program.**

▶ Common stocks of 10 out of 11 domestic trunkline carriers hit new lows for the year during the market slump early last week. Only Eastern Air Lines managed to hold slightly above its low for the year. During the market setback last Monday, United dropped as low as 18⅛ as compared with a 1957 high of 43¼ and Capital declined to 20¼ from a 1957 high of 26⅜. Trans World and National also showed large declines on the New York stock exchange. Both Northeast and Continental suffered similar losses on the American Stock Exchange.

▶ **Civil Aeronautics Administration will undertake badly-needed study of instrument flying requirements of helicopters. Program will begin this week at Washington National Airport with six CAA pilots using an HSS-1 helicopter on loan from the Navy. The HSS-1 is equipped with HF, VHF and UHF communications, Tacan, omnirange and distance measuring equipment, ILS receivers and automatic direction finders plus other navigational instruments.**

▶ Lockheed Aircraft is pushing Electra program in hopes of trimming at least one month off turboprop transport's production schedule. Original schedule called for roll-out on Dec. 11; first flight on Jan. 31. If the accelerated program is successful, the Electra may fly before the end of 1957. Manufacturer also is proposing a military version of the Electra for troop transport and litter service.

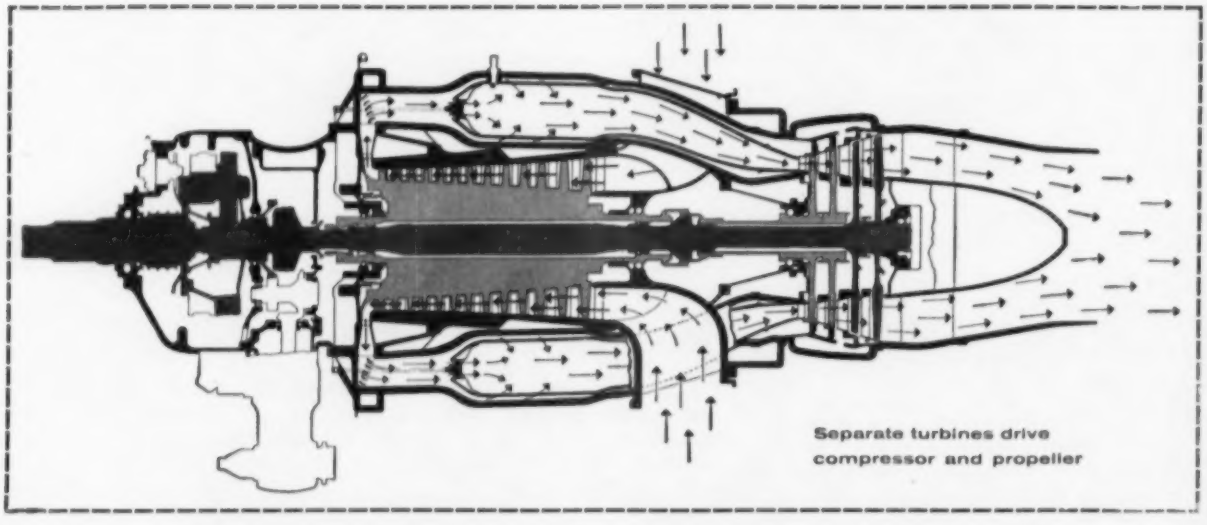
▶ **Capital Airlines President David H. Baker is now remaining close to his home office after an extensive period of travel throughout the system but will suggest that top-level staff members adopt similar travel programs as one means of bringing about closer coordination of the airline's activities.**

▶ William M. Allen, president of Boeing Airplane Co., says Boeing has achieved a substantial reduction in the noise level of the 707 but not without a decrease in thrust and an increase in fuel consumption. Allen says the costly research and development program on the noise suppressor was the result of public clamor against jet noise which, he adds, has been greatly overplayed. Airlines, however, are willing to make the sacrifice. Civil Aeronautics Administrator James Pyle said last week in Dallas that one airline had told him it is "willing to sacrifice $50 million over the life of its jet transports in the form of decreased loads in order to have noise suppressors."

▶ **Carter Burgess, president of Trans World Airlines, has called for limitation of government intervention in rate-fixing to "those extreme cases where competition does not work." Burgess said greater discretion by management in rate-making and a maximum of free enterprise is necessary to provide the public with a better service.**

THE REVOLUTIONARY BRISTOL PROTEUS

Most powerful engine in airline service, cuts fuel costs, solves noise problem



Bristol's pioneer free-turbine principle has been proven by actual performance. Powering the Bristol Britannia today, the Proteus delivers greater horsepower than any other engine in airline service—and, with a specific fuel consumption of only 0.445 lb/ehp/hour, is by far the most economical gas turbine in either civil or military service.

Pioneer Free-Turbine Design Impresses US Aviation World

US aviation experts who recently examined the Bristol Britannia were greatly impressed by the power, quiet, and all-round performance of her four mighty Proteus engines. This engine's remarkable flexibility is the result of an imaginative engineering concept . . . the revolutionary free-turbine principle, designed and developed by Bristol.

In the Proteus engine, the compressor and propeller are driven by separate two-stage turbines. There is no mechanical connection between the two systems, only a smooth gas stream.

Variations in propeller speed impose no limits on the output of the compressor and its turbine. The gas-producing section and propeller can each operate at optimum efficiency under all flight conditions, unlike the more limited single-shaft turboprop engine. It is because the Proteus' propellers turn so slowly that the Britannia, although much the most powerful, is the quietest airliner flying today.

World's Largest, Fastest, Quietest Jet-Prop Airliner Demonstrates Proteus Superiority

The Proteus is a revolutionary power unit for revolutionary times. It is a dramatic illustration of Bristol's engineering leadership, one of a long line of world-famous aero-engines. The Proteus combines great power with unrivalled economy, versatility, and low noise levels.

The Proteus powers the Bristol Britannia—world's largest, fastest, quietest jet-prop airliner—flying over 100,000 miles a week on BOAC routes throughout half the world. The reliability of the Proteus has been convincingly demonstrated by its outstandingly rapid increase in overhaul life since introduction into world service early in 1957. Moreover, maintenance requirements have proved to be far below those of piston engines.

BRISTOL

Aero-Engines

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REAR view of Dassault Etendard 6 clearly shows the scaled Mystere geometry, even to the high-set slab tail layout.

Sifting Begins of Lightweight Fighters

By David A. Anderton

Bretigny, France—SHAPE headquarters is sifting through results of the NATO light fighter competition here with the most likely outcome a recommendation to the various NATO country foreign ministries to consider one or more of the five entrants

All five were in flying condition at the end of the 160 flights made in the trials. Tough mission requirements were the crux of the competition, with the aircraft required to operate from unprepared fields and deliver nuclear or conventional weapons against enemy concentrations.

Designers were expected to produce planes capable of Mach 0.95 on the deck, able to take off from pierced steel planking, grass or a highway, able to clear 50 ft. in less than 3,000 ft. and able to roll at 100 deg. per sec.

Adequate navigational and communications equipment had to be included, the cockpit had to be pressurized and the whole airframe had to weigh in at less than 5,000 lb. empty.

Three planes were built to that requirement around the Bristol Orpheus 3 turbojet: Breguet's Taon, Dassault's Etendard 6 and Fiat's G.91. Two entries not designed to the specification were also competing, powered by Snecma Atar turbojets: Dassault's Etendard 4 and Sud Aviation's Baroudeur. The five were flown through a series of simulated missions and routine flight trials by a pool of NATO pilots.

None of the five meets all the specifications as far as can be determined.

None of the three Orpheus-powered entries can currently meet the takeoff requirement. Their thrust-weight ratio, originally planned to be about 1:2, has steadily dropped because of equipment additions or structural modifications.

Neither of the Atar-powered planes can meet the minimum weight limit. The Baroudeur, for example, weighs in at close to 10,000 lb. empty, which is twice the bogie of the specifications. The Atar turbojets alone weigh close to 2,000 lb. installed.

But Breguet and Dassault both have talked about advanced versions of their designs to be powered by the Bristol Orpheus 12 rated at 6,800 lb. without afterburner and 8,170 lb. with. These would be "production" versions, say the companies, and would differ in detail, dimensions and weights from the airplanes now being tested. But such advanced versions would meet the specification performance, they add.

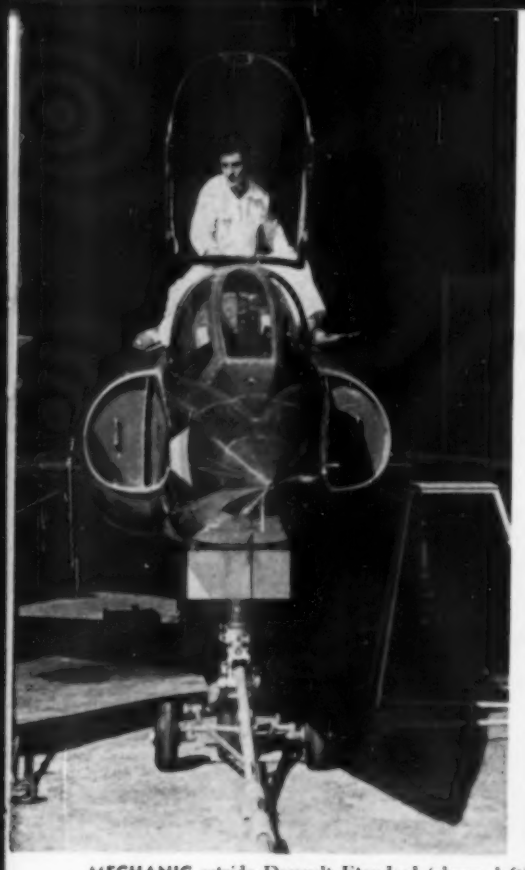
Dassault has a third string to its bow. It has entered the Atar-powered Etendard 4, which it says corresponds to a future Etendard 6 with an Orpheus 12, insofar as thrust-weight ratio goes.

So the competition boiled down to a flight evaluation of five airplanes, none of which meets the specifications and none of which is a true prototype for an aircraft that meets the specifications.

Descriptions of most of the competing aircraft have previously been published in AVIATION WEEK (AW Sept. 30, p. 26), but new details on some of the planes were revealed during the trials.

Breguet's 1001 Horsefly was the last of the entries to take to the air, delaying the competition by some months. While competitors were cursing the delay, Breguet engineers were refining the aerodynamics of the little fighter and reworking it to bring the airframe up to date.

From an engineering viewpoint, the Taon is about the most sophisticated of the entries. Aerodynamically it is a new configuration with low-set slab tail, area-ruled geometry and other tricks of the trade. Structurally it uses large sections of aluminum honeycomb fabrication, tapered wing skins and sub-assembly



MECHANIC astride Dassault Etendard (above, left) indicates plane's size. Etendard 6 nose (top right, above), gives pilot excellent visibility against ground targets. Leading edge of Etendard 6 wing (bottom right, above) has been extended to create vortex generator.

RUDDER of Fiat G.91 (top left, above) is shorter than on original, has inset tab. Nose (bottom left, above) has raised cockpit, machine gun armament on rigid side panels. Base of tail (right, above) is broader to accommodate structural changes made on horizontal surfaces.

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You get both of these critical features in TORQ-SET, the aviation fastener that lets you use *one* socket design for every aircraft fastening location. You get extra strength because it is a completely forged, single-piece unit, plus all the benefits of mass production in any size, style and head configuration. What's more, TORQ-SET offers extras in performance, too. It has the greatest wrenchability known in aircraft fasteners. It tightens tighter without burring or distortion and can be power driven. Yet the TORQ-SET design lets you remove it without difficulty.

Find out how TORQ-SET can solve your aircraft fastening problems. Write, wire or call American Screw Company, Willimantic, Conn.

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breakdown geared to a high rate of production.

Wingspan is the smallest of the entries at 22.3 ft. Overall length is 36.9 ft. and height in the three-point attitude is 12.3 ft. Weights are not available, but the efficient use of honeycomb should make for an overall lightweight structure.

A clue to the weight range of the airplane is given in the performance brochure, which presents parameters plotted against the weight. Minimum weight shown for landing performance is about 6,600 lb. and maximum shown for takeoff is about 13,000 lb.

Taon has power controls with artificial feel on all three surfaces around all three axes, plus a yaw damper in the directional control system.

Wing Construction

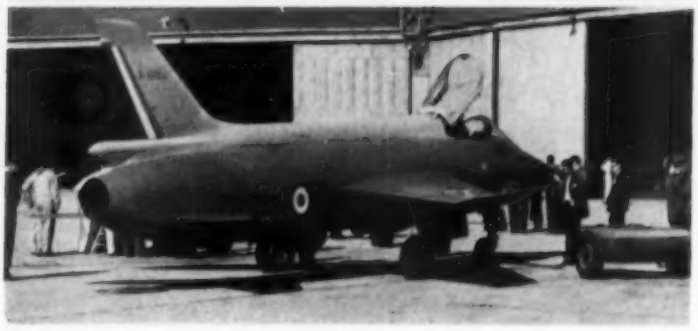
Wing area of the Taon is about 320 sq. ft.

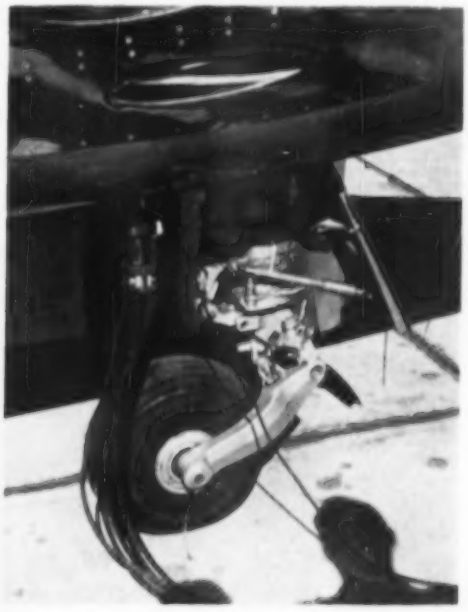
The wing itself is made basically of two tapered skins bonded to an aluminum honeycomb core. To this main bonded panel are fitted the double-slotted, two-segment trailing edge flaps, the leading-edge slats, the ailerons and spoilers.

The fuselage is broken into four sections for production. The small nose section houses all of the avionic gear. Cockpit and duct inlets form the second portion, which is honeycomb structure.

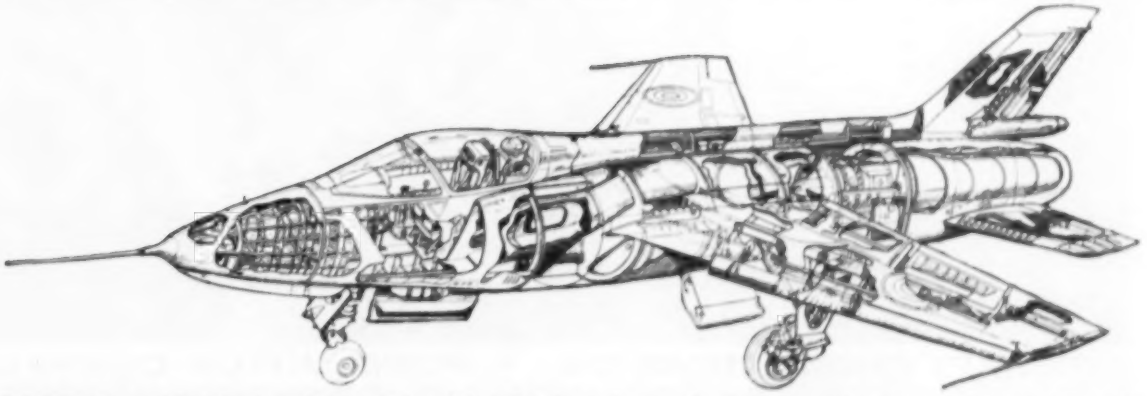
Main fuselage section is also a honeycomb assembly and contains the wing carry-through structure, armament bays and fuel tanks with a total capacity of 450 U.S. gallons. Fourth section is the tail cone and houses the engine, accessories and tail pipe, and mounts the vertical and horizontal tails.

Landing gear was designed and built by the French Messier firm. It is the now-conventional tricycle type, with large, low-pressure tires and cantilevered suspension. Main and nose wheel tire pressures are both 54 psi. Landing gear

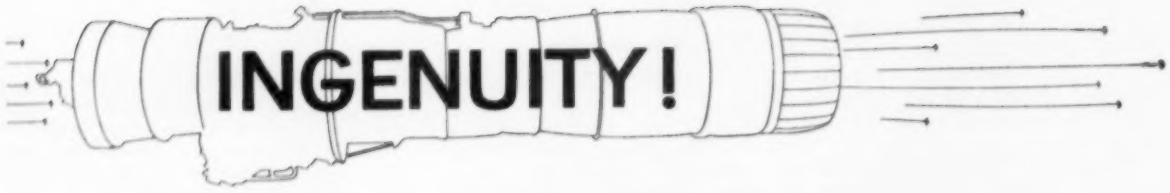




OXYGEN system servicing on Breguet Taon (left, above) is done during break in NATO trials. Low-set slab tail (left) is contemporary feature of Breguet design. Note relatively small size of wing, low thickness-chord ratio of wing and horizontal tail. Low-pressure tires (above) are feature of Taon.



CUTAWAY shows original structure of Breguet Taon. Ventral strake under nose has been removed on prototype, speed brakes added under belly.



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Our engineering and production specialists are constantly examining production methods to determine if new ways can be found to increase the quality of the job and, at the same time, lessen production time and cost.

In some instances, we have sliced production time in half on certain manufacturing operations of the J57. Of course, it takes skill, experience . . . *and ingenuity*.

Our jetmakers have a lot of each.

This ingenuity is an important factor enabling us to deliver quality jet engines, on schedule, at the lowest possible cost.

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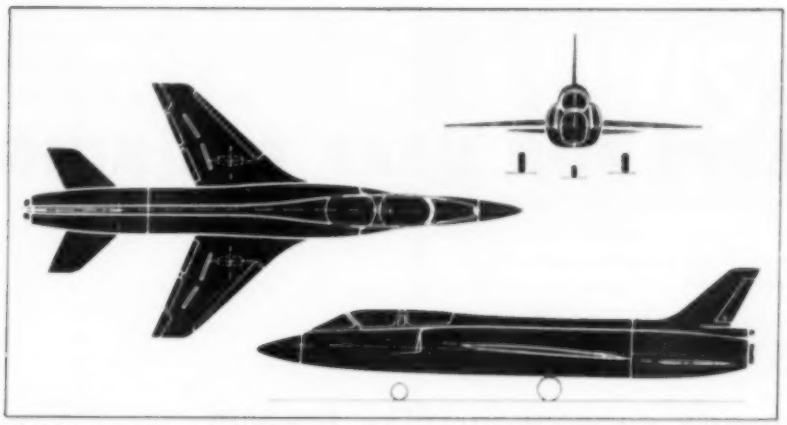

TAON two-seat trainer is development of original design. Wingspan is 22.3 ft., overall length 36.9 ft., height in three-point attitude 12.3 ft.

tread is 8.8 ft. wide and the wheelbase is 13.1 ft.

Avionic gear on the Taon includes an ARC-34 UHF set, an APX-6 IFF and coder equipment, an MSQ-1 set consisting of an APA-90 and APW-11, a Bezu NR.AN.8B radio-compass or, if desired, a Marconi unit, an ARN-21 Tacan equipment or a GTA-122 position maker, a telebriefing set for operational briefing and a Bezu Type 30 gyro compass.

Taon Armament

Standard armament on the Taon is four Browning .50-cal. machine guns, but these may be replaced with two French 30-mm. DEFA cannon with 240 rounds or by two Matra rocket launchers with 15 rockets each. External armament is carried on four wing pylons and includes as alternate loads two napalm tanks of 500 lb. each, 12 UK rockets, two five-inch HVAR rockets, two Matra 116C rocket adapters or two Nord 5103 guided missiles.

Like other entries in the competition, the Taon has two additional configurations offered. The photo-reconnaissance version results in a modified nose section to accommodate the four cameras with the left armament bay cleared out and filled instead with the radio and the right armament bay offered either with two .50-cal. machine guns, one DEFA cannon, or an extra fuel tank.

The trainer is a two-seater built around the Orpheus 4, a de-rated Orpheus 3 with reduced fuel consumption.

Breguet says the production airplane is designed around the Orpheus 12, and that the company has worked out the details on a two-seater with the Orpheus 12, used eitner for training or for other work.

Dassault Etendard

The Etendard ("Flag" or "Banner") series, now numbering eight different airplanes of which two are flying, is based on the aerodynamic geometry of the company's highly successful production-line fighter, the Super Mystère B.2. Scaled down, the same aerodynamic layout is used for wings and tail surfaces, in sweepback, aspect ratio and airfoil section.

Description of the three original progenitors of the series was published exclusively in Aviation Week (Oct. 10, 1955, p. 26).

Etendards 4 and 6 are flying in the competition. Both were designed to a similar specification, the 4 to a French ground-support role and the 6 to the NATO lightweight requirement. The Etendard 4 is powered by the Snecma Atar 8 and the Etendard 6 is powered by the Bristol Orpheus 3. Dassault considers the Etendard 4 a flying equivalent of the production version of the Etendard 6, which would carry the Bristol Orpheus 12 engine. The company says that in thrust-weight ratio and wing loading, the two planes are almost identical.

Area Rule Followed

Dassault proposes that production Etendard 6 aircraft should also incorporate the improvements being made in a version of the Etendard 4 being developed for the French Navy. An area-ruled fuselage is the major improvement.

Additional designs have been made for two-seater and photo-reconnaissance versions of both the Etendard 4 and the Etendard 6 with Orpheus 12.

Wingspan of the Etendard 6 is 26.9 ft., overall length is 39.5 ft. and the three-point height is 11.5 ft. Weights are not available.

Landing gear tire pressures are highest of the five entries at 64 psi. Tread of the tricycle gear is 10.1 ft. wide and wheelbase is 12.0 ft.

Cockpit of this airplane is not pressurized, but is air-conditioned. A con-

Waugh

AERIAL REFUELING FLOWMETER

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FEATURES:

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ventional oxygen system is provided.

Standard avionic gear and armament is included in the design.

Etendard 4 is Different

Etendard 4 is quite a different airplane, although at first glance it looks like an identical twin to the 6. Its larger engine was the result of the French specification which called for heavier armament than the NATO installation of four .50-cal. machine guns.

The Etendard 4 carries a pair of French 30-mm. DEFA cannon with 150 rounds per gun, plus a retractable rocket launcher with 32 rounds in the fuselage aft of the cockpit. In addition, underwing pylons can carry a variety of external weapons.

Wingspan of the Etendard 4 is 31.3 ft., overall length is 46.0 ft. and the three-point height is about the same as the Etendard 6.

Landing gear tire pressures have been lowered in this design to 50 psi. Wheel tread is 11.9 ft. and wheelbase is 16.7 ft.

Two-Seat Design

Dassault's design for the two-seater version replaces the rocket launcher installation with place for a second pilot. Normal armament is retained for operational mission use. The reconnaissance version of the Etendard 4 uses a photo camera pack in place of the rocket launcher, changes the nose section for a nose fitted with three cameras, and carries additional navigational equipment while retaining the pair of 30-mm. cannon plus the avionic equipment of the original.

Dassault's primary bid for the NATO contract is the Etendard 6 with the Orpheus 12 engine, rated at 6,800 lb. thrust and increased to 8,170 lb. thrust with afterburner (originally called "Wee-Heat but now dignified by the designation of BSR for Bristol Simplified Reheat). The Orpheus 12 is longer by about three feet and weighs about 500 lb. more. It also requires more air mass flow which means more inlet area and therefore more fuselage cross-section area. Since the fuselage had to be redesigned anyway, Dassault made the area rule modification it had incorporated in the drawings of the Etendard 4M for the Navy.

The Orpheus 12 version also requires more fuel for the NATO mission, but fortunately this could be accommodated in the extra fuselage dimensions required for balance and inlet area. The fuselage has been stretched aft to house the engine and the cockpit has been moved forward to balance the layout.

Wing area and empty weight have been increased; the allowance for extra weight includes cockpit pressurization (another item of Dassault design insurance just in case anybody wants

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Bill Remmert brought R-W services to Pompano. Behind him, a DC-3 conversion nears completion.

Bob Werner works most of his time at Remmert-Werner's home-base operation in St. Louis.

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Big-Change Artists

Over 200 aircraft conversions . . . thousands of corporate planes maintained and serviced . . . millions of gallons of Shell Aviation Fuel sold to satisfied customers—that's Remmert-Werner's 10-year record!

In June '56, a caravan of three giant mobile units left Remmert-Werner's home base, Lambert-St. Louis Municipal Airport. It was headed for Pompano, Florida.

Bill Remmert met the caravan. Utilizing its complete machine, woodworking, and electrical shops plus radio racks, stockroom and expert mechanics, he established another R-W-staffed base.

"When we took over the Pompano field," recalls Bill, "we needed fueling equipment—fast. Shell engineers came down and designed our bulk plant. And almost before we knew it, there were the three 15,000-gallon storage tanks we ordered waiting out there on flatcars, ready to go. Shell helped us zoom into business."

Besides servicing a good number of America's 28,000 corporate planes, Remmert-Werner also converts surplus commercial and military aircraft into luxury planes for private owners and corporations.

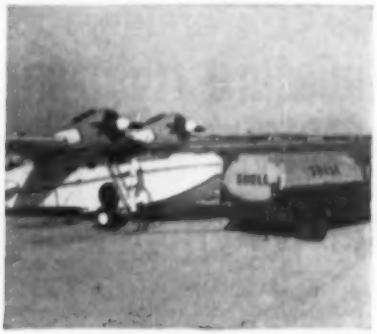
In an ordinary conversion job, R-W rips out every bit of wiring and piping, and installs completely new systems to customer specification. Lounge chairs and sofas, tables, lamps, galleys and any other special furnishings are designed and built by R-W craftsmen.

Among the organizations that happily fly Remmert-Werner conversions are Olin Mathieson Chemical, Grumman Aircraft, Hercules Powder and Owens-Illinois Glass.

"It didn't take long for us to find out that when you're a Shell Dealer, business flies your way," says Bill. "Shell works right along with you, helping you build your business. They've even helped us locate old DC-3's when they've been hard to get. A Shell man spotted some while traveling in Turkey last year. We went right over there and bought them. Most of those '3's' have already been converted into flying yachts."

If their first 16 months at Pompano is any indication, Bill Remmert and Bob Werner are on their way to making R-W service available to America's ever-increasing fleet of corporate aircraft.

Before: C. S. Weaks (right), R-W sales manager, and client discuss plans for a Grumman "Goose."



After: R-W serviceman fuels a converted "Goose" with Shell Aviation Gasoline.

Before: R-W craftsmen remodel interior of DC-3. They'll install new wiring, insulation, picture windows, and furnishings to order.

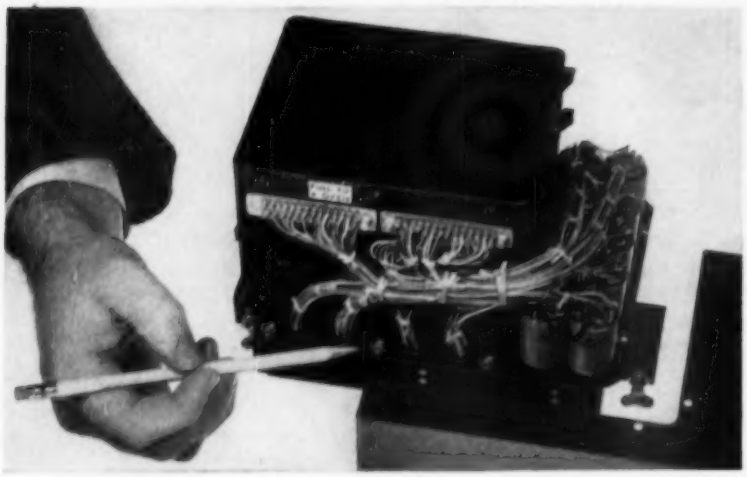
After: Betty Remmert (right) shows prospective client through completed interior. R-W conversions sell for as much as $300,000.

It pays to be a Shell Aviation Dealer

—and the Shell office nearest you will be glad to show you why

SHELL

FASTENER PROBLEM



Miniature right-angle stop nut for cover hold-down saves space and weight on avionic unit

This is United Control Corporation's advanced Master Warning System Control—designed and developed to reveal any aircraft system malfunction. It is used on the supersonic Republic F-105 Thunderchief and like all key avionic components this equipment must be lightweight, compact and highly dependable.

THE PROBLEM: How to attach a dust cover securely, with provision for easy removal for inspection and a high degree of fastener re-usability. Yet this fastening job had to be done within minimum weight and space allowances.

THE SOLUTION: A miniature, right-angle basket nut—Type A27M—especially developed for blind mounting applications, with a high re-use nylon locking insert, provided the answer. A built-in "float" permits the nut to be self-locating—to compensate for a reasonable amount of misalignment between nut and screw. If high temperature had been a problem ESNA could have supplied Type LHA27M which has the same features as Type A27M plus an alternate type of locking device which withstands heat up to 550°F.

YOUR FASTENER PROBLEM can be solved as easily and efficiently as this right-angle basket nut application. So why not mail this coupon today?

ESNA's line of right-angle basket nuts, shown above in actual size, includes the standard size A27 for applications where space is no problem, the miniature A27M, and the high temperature miniature LHA27M.

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an interceptor mission flown with these airplanes).

Four .50-cal machine guns and 1,200 rounds can be carried as the standard armament, but since there is more room for armament in the fuselage, it is possible to use either a 500-round 30-mm. cannon pack or to install a rocket launcher with 55 2.75-in. rockets.

Avionic gear has been increased to include ranging radar and Dassault's "Aida" equipment which gives range, azimuth and elevation of the target on cross-pointer meters, providing what the company calls "semi-all-weather firing" of the armament.

This version of the Etendard 6 can also be made into a two-seater or a photo-reconnaissance airplane.

Wingspan of the Etendard 6 with Orpheus 12 is 28.0 ft., overall length is 42.3 ft. and three-point height is about 11.5 ft. Landing gear tread is 10.8 ft. and wheelbase is 14.2 ft.

Fiat G.91

Italy's pride, the Fiat G.91, was exclusively described in AVIATION WEEK, June 10, p. 50. Since the flight tests of the first prototype, which were ended when the plane broke up in the air following tail flutter, Fiat has modified the plane in a couple of respects.

Most obvious is the tail fix. Base of the vertical tail has been widened and internal structural changes have been made to prevent the troubles from happening again.

Main wheels, which on the first prototype carried 64 psi. tire pressure, now carry only 50 psi., according to the stencils on the gear fairing.

In addition, the cockpit has been raised about one inch, a ventral fin strip has been added and the horizontal tail dimensions were increased.

Performance is considerably improved over the first prototype which was powered by an early Orpheus.

Sud Baroudeur

The Baroudeur ("Tough Guy" in Legion slang) is probably the only airplane in the contest that really has rough-field capability. Anyone who has observed the breathtaking ground runs of this craft under the skillful guidance of Sud's Tito Maulandi or USAF's Major Arthur (Kit) Murray, is always impressed. It's not until after that the observer is inclined to be glad that someone else was making the takeoff.

It is an awesome sight to see the Baroudeur rocking along over the turf, trailing a long plume of dust and scorched earth behind it, bounding from hillock to hummock like a seaplane on the step and leaping into the air from the last of the bumps, all after a run of less than 2,000 ft.

But once the spectacular takeoffs and

fog-free visibility with Sierracote

The plastic canopy of Convair's new supersonic all-weather interceptor — the F-106A — is coated with Sierracote to provide an electrically heated fog-free surface.

The culmination of a Sierracin-sponsored development program extending over several years, Sierracote is proving an eye-opener for two simple, significant reasons. It *prevents formation of fog on inner surfaces of windows and canopies*, and *reflects up to 75% of solar heat rays*.

In addition, this electrically-conductive, transparent coating is *adaptable to areas of compound curvature*.

Today, this efficient coating is providing better visibility in Convair's new Delta Dart and in other top-rated aircraft. A new technical bulletin describing Sierracote in detail is now available. Write for your *free* copy today.

Sierracote *is a new, electrically-conductive, transparent coating that provides a fog-free surface for plastics and glass.*

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landings have been demonstrated, the soundness of the concept begins to sink in.

This airplane, equipped with skids instead of wheels, can conceivably take off from any surface that can support the weight of the plane.

Skid pressure on the ground is a low of 14 psi.

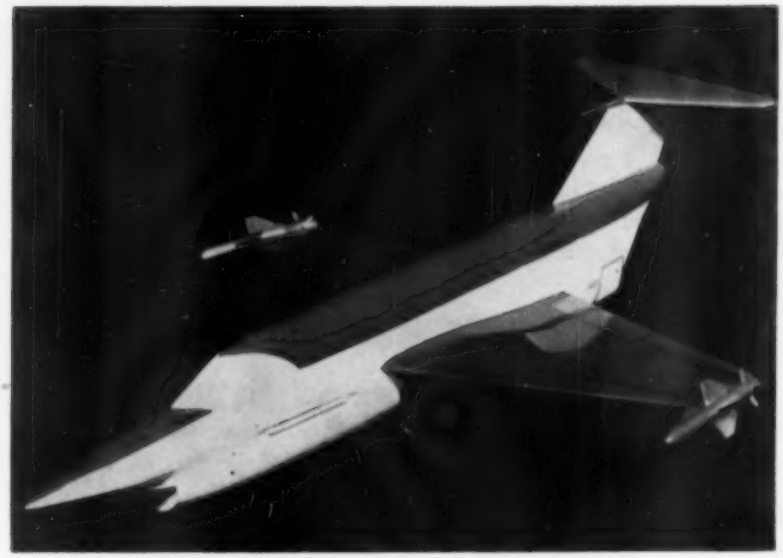
The plane can taxi well on the ground, and use of the "plow" brakes that dig into the ground gives excellent maneuverability. Turning radius is less than 45 ft. Recovery takes a few men and a light trailer plus one prime mover.

Baroudeur Well Tested

The Baroudeur first flew four years ago. Since then it has been operated from simulated desert surfaces at Istres, on muddy grass with bumpy surface at Villaroche, on soggy, irregular earth like a plowed field at Tours, on the beach at La Baule and on a simulated bombed grass strip with craters filled with loose earth at St. Nazaire.

The company says that the Baroudeur has thus proven that it can take off from fields where only a command car type of vehicle could move, and can land on fields in which these vehicles would be bogged down.

Wingspan of the Baroudeur is 32.8 ft., overall length is 44.8 ft. and three-point height is 10.8 ft. Gross weight is 13,575 lb. and the weight empty is about 9,612 lb.



SR.177 Configuration

Model of Saunders-Roe SR.177 mixed powerplant interceptor shows Firestreak rockets mounted on wingtips. Naval all-weather, high altitude plane will be powered by de Havilland Gyron Junior supersonic turbojet and fully controllable de Havilland Spectre rocket engine. Overall configuration suggests that plane will operate in Mach 2 range. SR.177 is somewhat larger than SR.53, carries more operational equipment. Combination of rocket and low landing weight should permit short runway, tactical air strip operation.

Merger With Monroe Planned by Litton

Impending merger of Monroe Calculating Machine Co., with Litton Industries was announced last week. Stockholders of Monroe representing approximately 80% of that company's stock have accepted the offer of board of directors of Litton to purchase outstanding common stock.

Monroe stockholders have been offered the choice of 1½ shares of Litton common stock for each share of Monroe common or ½ of one share of Litton $100 par value 5% preferred for each

Add Launchers

Two additional underwing pylon stations for Falcon missiles are tested on special Northrop F-89D-NO Scorpion at Edwards Flight Test Center. Planes formerly carried one under each wing, plus tip pods.

ENGINEERS: *Contact our Technical Placement Manager for employment data.*

Aviation history can be told in numbers, and *880* seems destined to write a page of its own. In 1960, Convair 880, the world's fastest jetliner, will be in service. 880 will cruise at 615 mph, carrying 80 first-class or 108 coach-class passengers. The new Convair will combine spacious luxury and unprecedented commercial speed with operating economy.

Power will be four CJ-805's—General Electric's spectacular turbojet. CJ-805 is a variable stator, single rotor engine in the 10,000 pound thrust class. J79—its famous military counterpart—drives aircraft at twice the speed of sound!

UAP components are supplied to GE for both the CJ-805 and J79, as listed below. Here development was a challenge because the GE turbojets were designed for a higher thrust-to-weight ratio than any large jet engine in production. To meet specifications, UAP developed components of minimum weight and size commensurate with highest strength and optimum performance. If you require dependable, high-quality aircraft essentials, often exceeding specifications in design and manufacturing, UAP will prove a versatile and reliable source. Write today for information.

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- Fuel control valve
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1116 BOLANDER AVENUE, DAYTON, OHIO

share of Monroe common. Approximately 300,000 shares of Monroe common stock are outstanding.

Monroe sales for the current calendar year are estimated to exceed $40 million and company's current total employment is over 5,000. With the inclusion of the sales of Maryland Electronic Mfg. Corp., and Aircraft Radio Corp., Litton Industries' annual sales are currently at the rate of over $45 million.

$8 Million Engine Order Placed by West Germans

Orenda Engines Ltd., Toronto, Ont., has received an order amounting to $8,000,000 from the West German Air Force for spare Orenda 14 engines and parts. The order is the first for spares in connection with the order placed some months ago by the West German Air Force for 225 Canadair Sabre VI fighters equipped with Orenda 14 engines. The order for spares must be completed by next August.

Magnetic Tape Recorder Ordered for Navy Planes

Bureau of Aeronautics awarded a $1,760,000 contract to Autonetics, a division of North American Aviation, Inc., for pilot line procurement of an advanced airborne magnetic tape recorder. Device is capable of recording voice and automatically recording the attack display information of the fire control system. Known as Nadar VIII, recorder is planned for installation in several all-weather Navy interceptors.

Pressure Suit

Scientist shows he can use wrench while wearing pressure suit that protects him from 95-mi. altitude simulated in Litton Industries, Inc., chamber developed for Air Force ARDC (AW Oct. 14, p. 62).

THESE ARE THE FACILITIES OF

CLEMCO
AERO PRODUCTS, INC.

geared to lead the field of aircraft and guided missiles for the world today... for the universe tomorrow

CLEMCO's Research, Engineering, and Production facilities have been carefully planned to provide and maintain the highest performance. More than 200 engineers, technicians, and highly skilled craftsmen with a high degree of specialized training are employed in CLEMCO's 85,000 square foot plant . . . all working together to provide the aircraft and missile industry with products of superior quality and complete dependability.

- Pond Planer with six foot clearance over 102" x 300" vacuum chuck table, British Planer with four feet head clearance over 72" x 144" table with vacuum chuck, plus converted Cincinnati Planer and 3-D and 96" x 144" vacuum chuck.
- 19 3-D Profiters ranging in size up to 96" x 240" table.
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This is #2 of a continuing series of advertisements prepared especially for the advancement of the aircraft industry by CLEMCO. Keep a file of them so you will have the complete story of CLEMCO.

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Russian Scientist Wants Students Assigned Earlier to Engineer Work

Moscow—A top Russian Air Force scientist is in sharp disagreement with faculty members of the USSR's famous Zhukovsky Air Engineering Academy over how soon students should be assigned to practical design and development work.

V. Pugachev, Major General of Engineering and Technical Service, writing in the Red Army newspaper *Red Star*, advocates that Russian aviation engineering students who have completed their second year should participate in specific development projects as part of their academic training.

He says that the urgent necessity of solving problems now confronting Red Air Force scientists demands that future engineering officers who have passed their basic theoretical courses be given practical assignments immediately.

Pugachev, who is also a professor and doctor of technical sciences, complains that most of the diploma projects of Russian aviation engineering students have done no more than testify to the individual's book learning, since they never find practical application.

Professors Object

But many Zhukovsky Academy professors stoutly defend the existing method of instruction and diploma project planning. They point with alarm to the danger of diverting students from "deep theoretical study" and argue that Pugachev's plan would transform the Zhukovsky Academy and other Soviet air engineering institutes into junior-grade design bureaus.

Pugachev first presented his proposals at a scientific conference of the Zhukovsky Academy's staff. When they aroused stiff opposition, he sought support for his case through the USSR's official Defense Ministry newspaper *Red Star*.

The general admits that his suggestions cannot be adopted at once because they will require considerable change in the Zhukovsky Academy's program.

But he denied charges that his proposals would turn the Zhukovsky Academy into a design bureau.

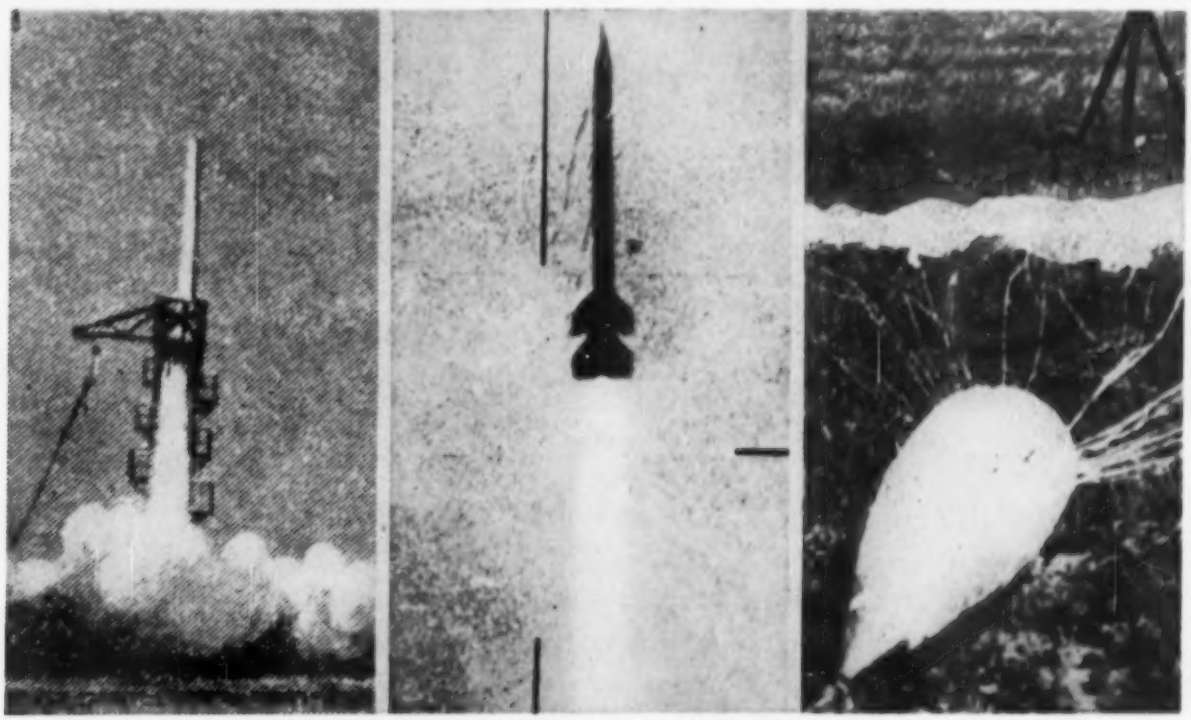
Fears Are Groundless

"Such fears on the part of the professors are groundless. Serious and truly scientific solutions to practical problems are unthinkable without thorough mastery of theory. A student's effort to do independent creative technical work is an additional stimulant which impels him to study all the scientific knowledge in a given field.

"Furthermore, the design experience acquired by the student at the engineering academy will be of great help to him when he graduates and is assigned to practical, creative work in an Air Force unit."

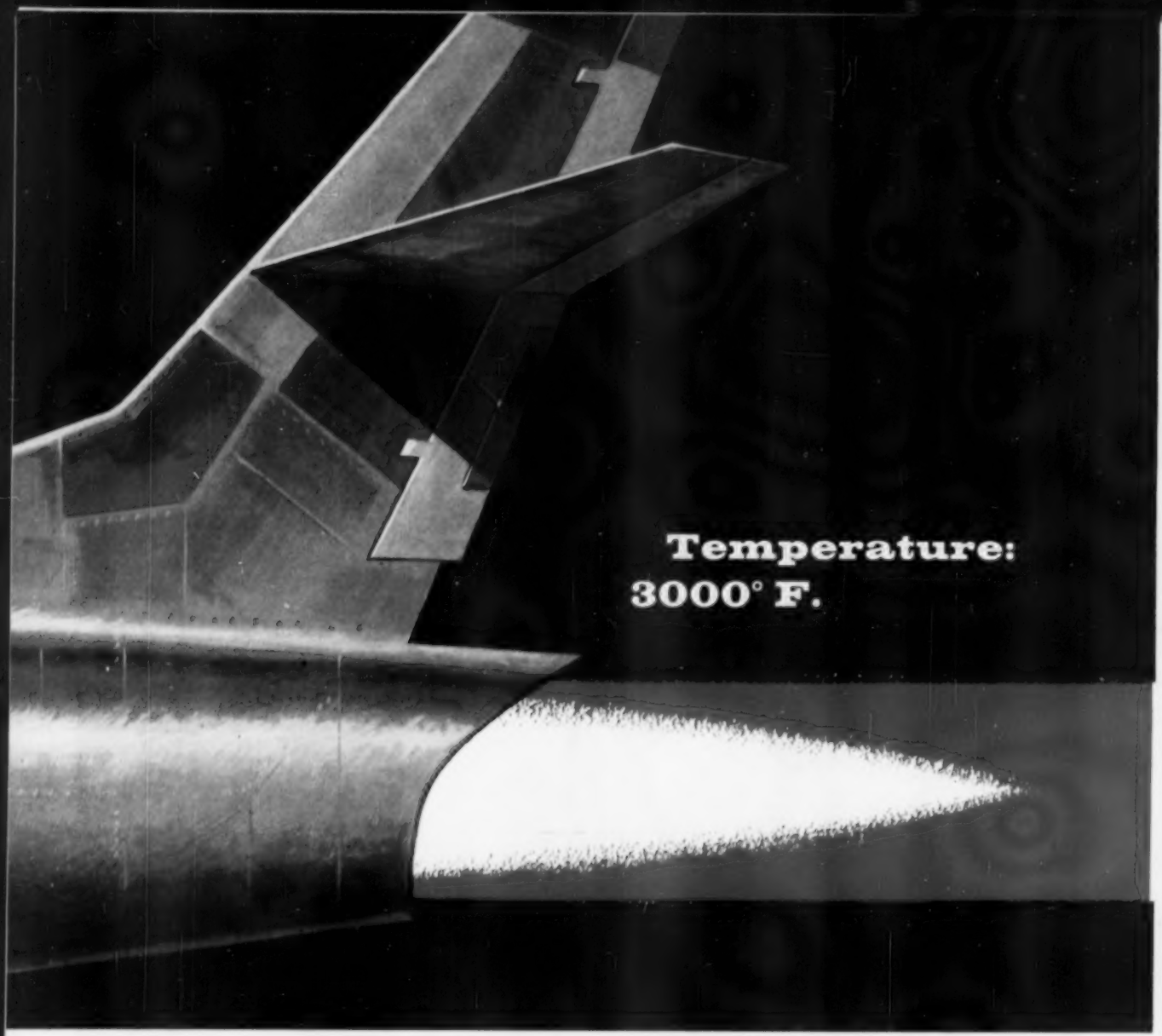
In his *Red Star* article, Pugachev declares:

"The laboratory and course work and the diploma projects of aviation engineering students can and must be



Russian Meteo Rocket Firing

Russian Meteo rocket used in IGY program, shown in firing, weighs about one ton, stands 29 ft. high. It is in effect a three-stage rocket, with the first stage a hollow cluster of six solid-propellant rockets. Second-stage sustainer, with nitric acid and aviation kerosene as propellants, fires through the core of this cluster, and is started at the same time as the booster firing. Boosters burn out at low altitude, but sustainer carries the rest of the rocket to about 44 mi. at sustainer burnout. Small solid-fuel rockets separate the nose cone and extend the trajectory somewhat. At separation, the nose cone streams a parachute which trails unopened in the thin air of high altitudes. A second parachute lowers the main body of the rocket with its sustainer thrust chamber to earth (right). Nose cone parachute opens at about 40 mi. on the descending leg of the trajectory and eases the instrumentation to earth slowly. Earlier photos of Meteo appeared in Aviation Week Sept. 9, p. 40.



57-45

Dual orifice fuel nozzles control the flow of fuel to the combustion chamber of a jet—hot as a blast furnace! The advanced design and precision manufacture of these nozzles provide optimum engine combustion efficiency. Ex-Cell-O builds such fuel nozzles... along with blades, rotors, actuators, valves, fuel controls, parts and assemblies.

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MAN AND MISSILES FLY HIGHER, FASTER AND SAFER WITH PARTS AND ASSEMBLIES BY EX-CELL-O

closely tied to pressing practical problems.

This will enable our future aviation engineers to acquire a higher feeling of responsibility for developing themes in their chosen field and will permit them to become accustomed to solving practical problems on their own.

"It seems to me that beginning with the third year, when the students have mastered the basic engineering subjects, they are able to carry on useful practical work which is, at the same time, an essential part of their academic training. To do this, the aviation institute's curriculum must be organized so that each upper division course, laboratory or practical assignment is an integral part of the scientific research work being conducted by a particular chair.

"As for the students' diploma projects, it is necessary to choose only those subjects which have actual significance to the armed forces."

Old Concept

Pugachev noted that his ideas are not new. In certain faculties of the Leningrad Polytechnical Institute students in their third and subsequent years do independent scientific research work in laboratories as part of an overall problem that is being solved by a chair.

Diploma projects at the Moscow Physical and Technical Institute are based on practical problems.

"In my opinion," Pugachev continued, "students' diploma projects in the various Air Force technical institutes must represent a final development of some item of military technology which has been brought to the drawing board stage.

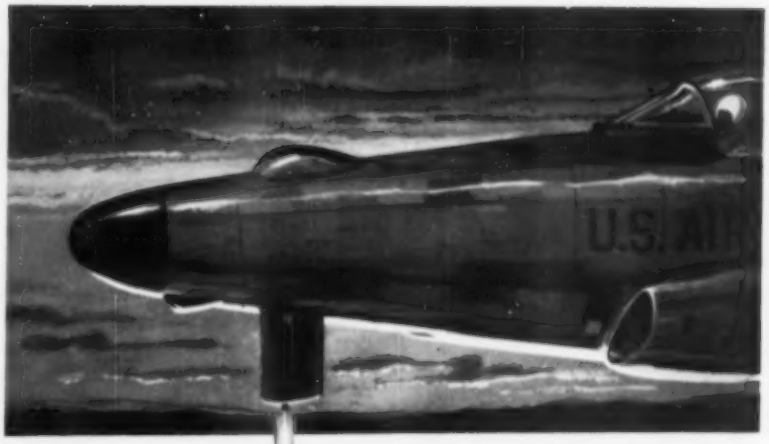
"The project must consider the requirements of actual operational employment of this item. Thus the students' work can be used to accelerate the creation of new types of military hardware."

Good Administration Required

Pugachev conceded that adoption of his ideas would necessitate skillful administration of Air Force engineering institute chairs.

He said that department heads would have to be constantly aware of actual Air Force problems, show a high degree of initiative and demonstrate that they have the ability to coordinate many parts of an overall project.

"We must," he concluded, "recognize that the task of training highly qualified Air Force specialists in connection with the fast development of military science and technology acquires ever greater significance. Solution of this problem by old methods does not yield the necessary results."



Kentucky Windage at 650 MPH?

"Kentucky windage" is fine for an oldtime squirrel shooter at 60 yards. But how do you compute cross-wind allowance for high-speed jets aiming at fast-moving flank targets?

The compilation of firing tables required for cross-wind cannon firing is typical of the complex problems facing modern weaponeers. The special abilities of Thieblot Aircraft Company, a division of Vitro Corporation of America, in designing and manufacturing aircraft components and ordnance have made it a key member of the Army-Air Force team working on this difficult ballistics problem.

Thieblot's contribution was the design of a new ballistics data nose. Only a foot longer than conventional fighter noses, it carries a 20 mm. cannon with mount independent of the aircraft motion, four high-speed cameras, radar, and electronic equipment. With auxiliary ground controls this equipment "fixes" projectiles in time and space. This leads to greater protection for bombers and other combat aircraft through more accurate flank fire.

The design of this ballistics data nose is one of many examples of Thieblot's capability in designing, developing and manufacturing aerodynamic systems. Other Thieblot projects include purge mat system for jet trainers, boundary layer control system, nose-wheel steering mechanism, inflight refueling unit, escape reel for ditched aircraft, and C-46 modification kits.

Thieblot offers a complete engineering program to include engineering services, parts manufacturing, testing and production in a co-ordinated program that saves time and money.

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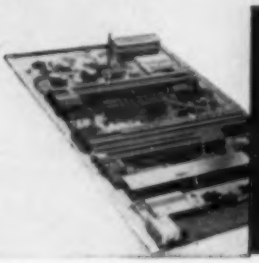
BY KROPP

Forgings are vital parts in every plane that flies . . . and *quality* is the most important ingredient. The Kropp "symbol of quality" is the mark of an organization that has gained a reputation for excellence of product through competent and thorough engineering, outstanding craftsmanship and many years of forging experience. For low weight-to-strength ratios, uniformity of parts and maximum resistance to stress and strain, you need forgings . . . and where forgings can serve you, Kropp will serve you best. Our engineering and research departments as well as our complete manufacturing facilities for forging steel, titanium or special alloys are available to you. Send us your inquiry.



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CHICAGO 50, ILLINOIS

Missile Oven Creates High Temperatures

Cylindrical oven using thousand-watt infrared lamps as a heat source simulates temperatures encountered by Boeing Airplane Co.'s IM-99 Bomarc in supersonic flight.

Tests are being conducted by the Pilotless Aircraft Division, Seattle, to determine how temperatures within portions of the missile such as the electronics section vary as a result of friction against the air.

Tests also indicate the effectiveness of the Bomarc cooling system and of a layer of insulation inside the missile that is designed to retard the inward flow of missile skin heat.

Laboratory temperature testing is less expensive than gathering data from test flights and yields more information, according to Boeing.

Test Chamber Houses Nose Section of F-101

Altitude chamber big enough to house the nose section of a McDonnell F-101 is being used by Garrett Corp.'s AiResearch Manufacturing Division to simulate 50,000-ft. atmosphere, 65F temperature.

Chamber was built so that company's radar, heating and refrigerating components could be tested in installed location without flight testing.

Only the cabin and its AiResearch components are under test. Company expects test facility, located in Phoenix, Ariz., will reduce lead time, improve aircraft performance and permit testing to be done at a fraction of the $10,000 or more an hour that airborne flight testing costs.

Two-place F-101B is being tested. Only two "B" models are flying at the present time, but plane will soon be produced in volume.

Computation Service Offered to Industry

Ramo-Wooldridge Corp. of Los Angeles has established a Computation Consulting and Service Bureau for business and industrial organizations. Bureau will be operated as part of the company's digital computing center. Consulting in computer applications and digital computing services including numerical analysis, programming and equipment rental, will be some of the services offered.

Personnel time for the preparation of programs for digital computers will be offered under a time and materials master type contract or a fixed price type contract.

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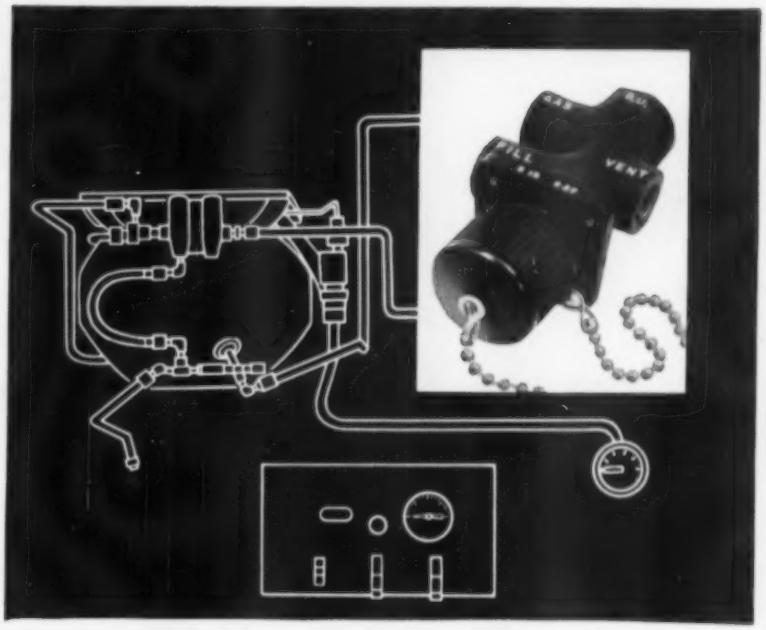

AGAIN! ANOTHER BENDIX FIRST!
NEW COMBINATION FILLER-BUILD UP VALVE
SAVES SPACE! SAVES WEIGHT!

Here, now combined in one unit, are the functions of a separate liquid oxygen filler valve and a separate build-up and vent valve . . . the new Bendix FR-7! It reduces valve weight by 50%. It substantially cuts critical space requirements, and it minimizes possibility of human error by providing automatically the proper build-up position.

Here . . . in this latest "first" . . . is added evidence of Bendix leadership in the pioneering of better products and advanced equipment in the liquid oxygen field.

Since the development of the first production-liquid-oxygen converter . . . as in this new FR-7 . . . Bendix has consistently led in the creation of significant improvements.

For full details on the FR-7 write: PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA.

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THE FIRST
practical liquid-oxygen converter.

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air-borne liquid-oxygen system.

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liquid-oxygen capacitance gage system.

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economy circuit for low-pressure systems.

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quick-disconnect filler valve.

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current standard converters (5, 8, 20 and 25 liter).

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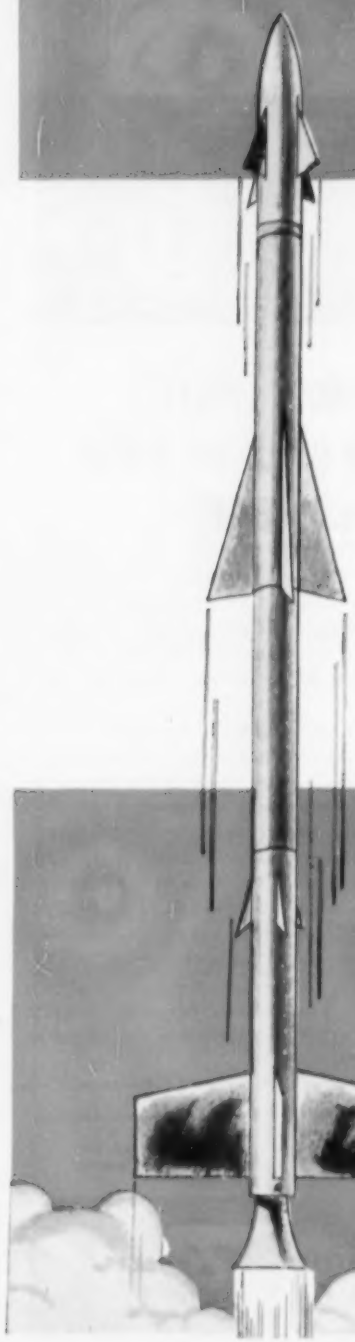
Bendix AVIATION CORPORATION

SPEED YOUR MISSILE

Precision Weldments in Stainless

FROM THE LEADING PRODUCER



Welding of all types on special steels and alloys can be contracted for confidently at the Jet Division.

Our experience in forming, welding, stress-relieving, and heat-treating titanium, high-alloy and stainless steels for jet engine components is available to you now for your missile programs. Deliveries will be prompt, quality will be to your required standards. Our engineering staff can also help you design and engineer weldments of all types.

Machining of weldments can also be done right in our own plant by people accustomed to closest tolerances, unusual alloys and designs, and aircraft-quality standards.

Let the Jet Division supplement your own overloaded missile production facilities. Capital investment will be eliminated, the search for qualified engineers and production people will be avoided. Delivery will be made to suit your production schedule. Write today for a Jet Division Sales Engineer to call.

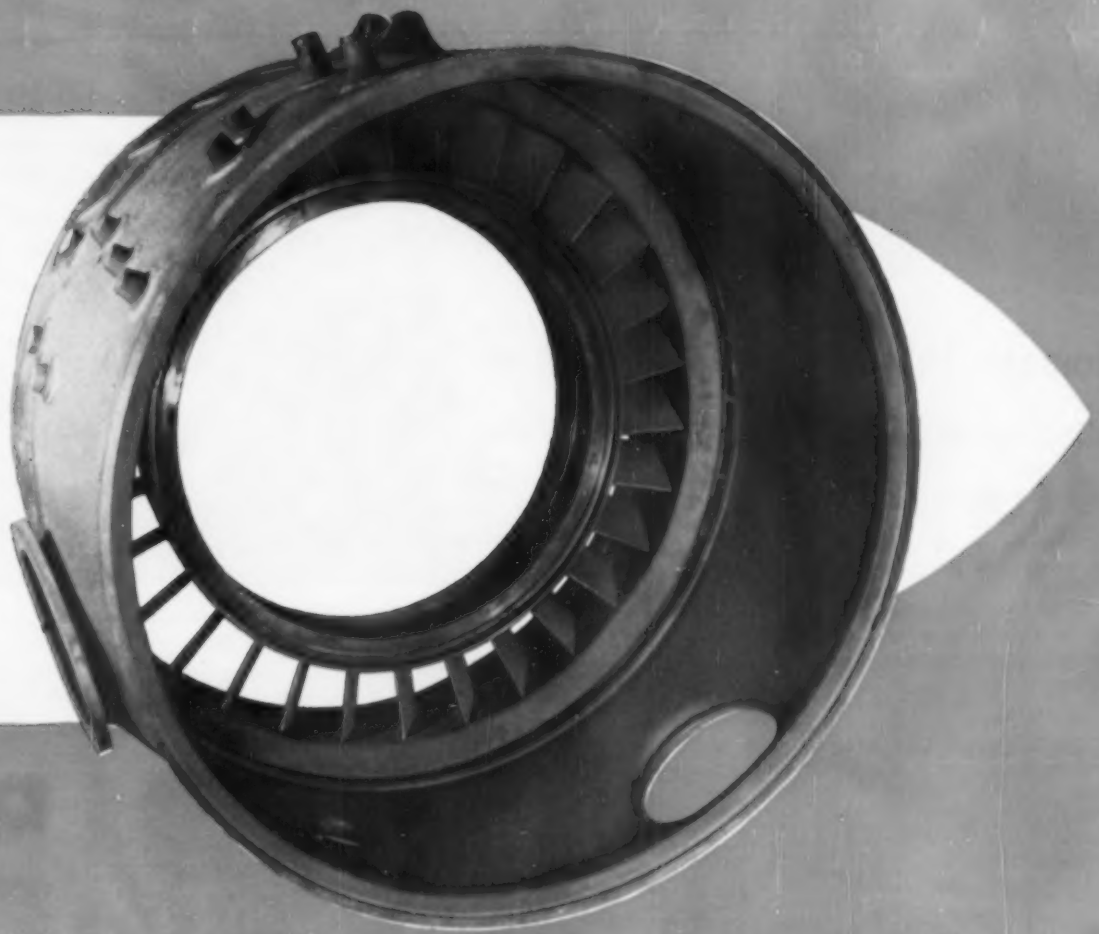
SEND FOR BOOKLET AW-767

which describes the facilities and products of the Jet Division in detail, shows how you can use these facilities to best advantage.

PROGRAM WITH

and High-Alloy Steels and Titanium

OF JET-ENGINE PARTS



JET DIVISION

Thompson Products, Inc.

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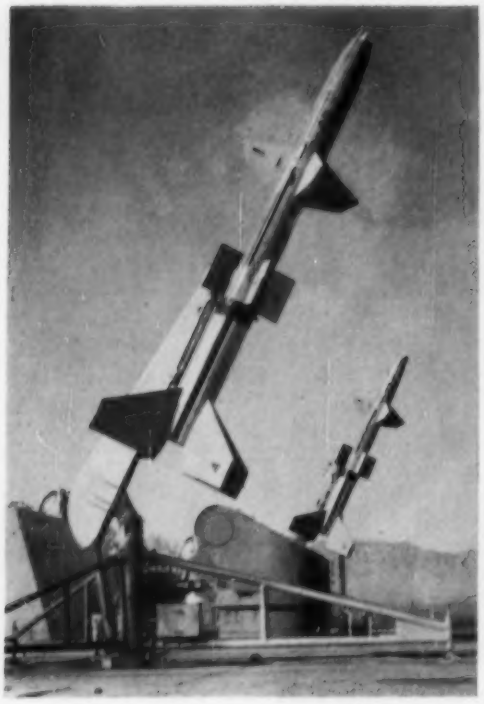


Automatic Talos Missile Evaluated in 'Desert Ship'

Talos shipboard launchers are shown above being readied for firing. Ground installation for Talos is at right. Missiles are automatically carted out from concrete storage cells at rear, transferred to launcher.

Operations building (foreground) houses computers, radar, fire control system. Assembly building, launch pits are behind.

"Missiles are a different breed of animal!"

You hear that statement often these days, as engineers and production men shift their thinking to meet the dawning missile age.

For the past 10 years "ultra-reliability" has been the byword at Electro Tec Corporation.

We have achieved it by developing unique designs and methods that now place us in a leading position to meet the even greater emphasis placed upon reliability by the stringent requirements of missile control and guidance systems.

It costs no more to have the assurance of Electro Tec's "ultra-reliability" — and it is rooted in demonstrable scientific facts.

Take our slip ring assemblies, for example:

Cross section of 34-ring Slip Ring Assembly showing exclusive "Symmetrical Construction." (Enlarged 1½ times)

1. **Mechanical stability under high temperatures, shock and vibration,** and greater strength are the result of **symmetrical construction** throughout, and the use of a hardened center wire. (See illustration at left.)

2. **Ultra-reliable electrical performance,** lowest noise levels, more uniform wear because the exclusive* Electro Tec processes permit the use of pure **24K gold** and fine silver instead of alloys.

3. **Molecular bond*** of ring to wire assures positive, permanent connections under high temperature, shock and vibration.

These are the points of Electro Tec superiority that add up to "ultra-reliability" in the air and on the shelf — now . . . *or three years from now!* Electro Tec Sales Engineers are available in all parts of the country. Write to;

"Ultra-reliability" for the missile age.

* U. S. Pat. 2,696,570. Other patents pending.

ELECTRO TEC CORP.

South Hackensack, N. J.

Products of Precision Craftsmanship

Next logical step after Vanguard?

THE FAR SIDE OF THE MOON

We don't know what we'll find there—it's the side of the moon we never see.

Yet, after Project Vanguard, a flight to the moon—and a look at its far side—would be the next logical step in our penetration of outer space.

To make this step, we must solve the problem of guidance: How do you direct a rocket out and around the moon and then back to earth?

The most promising method to date would include the use of inertial guidance systems such as Honeywell has helped pioneer and develop.

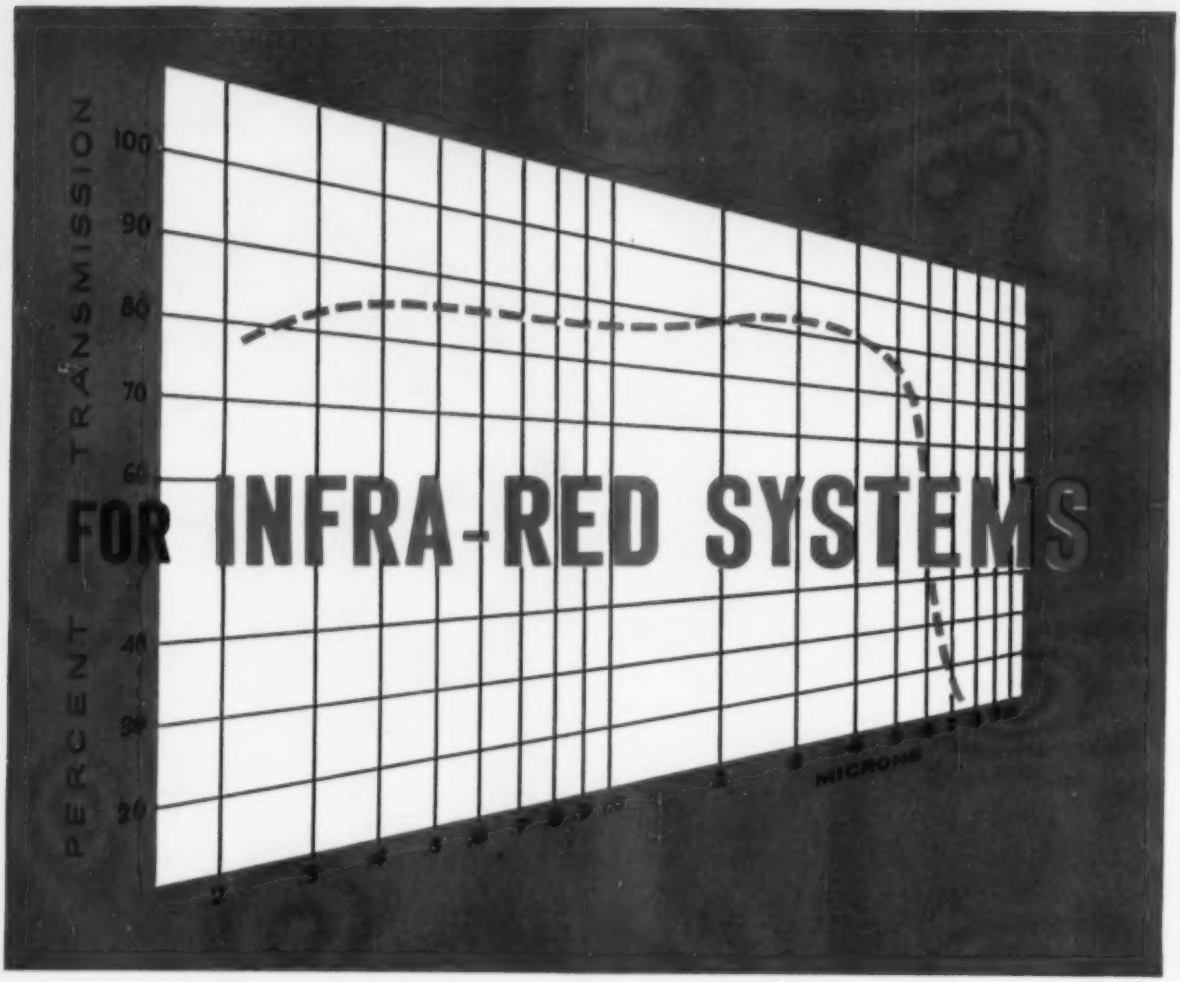
Honeywell's inertial guidance systems consist of ultra-precise gyros, accelerometers, computers and associated electronics that enable a missile to know where it is and how to reach its destination by "remembering" where it started from and where it wants to go. It provides guidance far beyond the reach of radio or radar.

Pioneering in the research, design and production of airborne controls has given Honeywell Aero the advanced technical competence you can rely upon in the solution of your airborne control problems. Contact Minneapolis-Honeywell, Aeronautical Division, 2600 Ridgway Road, Minneapolis 13, Minnesota for valuable assistance—from original planning to final production.

Actual photo of the Honeywell space reference system designed for Project Vanguard. This Honeywell inertial-type guidance system will guide stages one and two of the Martin-designed earth satellite launching vehicles. Third stages will then cut loose to position satellites in their orbits.

Honeywell

H Aeronautical Division



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Hard—Moh 9
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LINDE Sapphire has...
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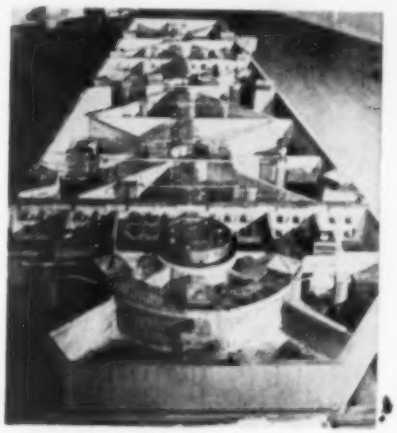
PRODUCTION BRIEFING

North American Aviation, Inc., Columbus, O., recently installed a table to hold wing panels for precision milling. It consists of four aluminum sand cast-

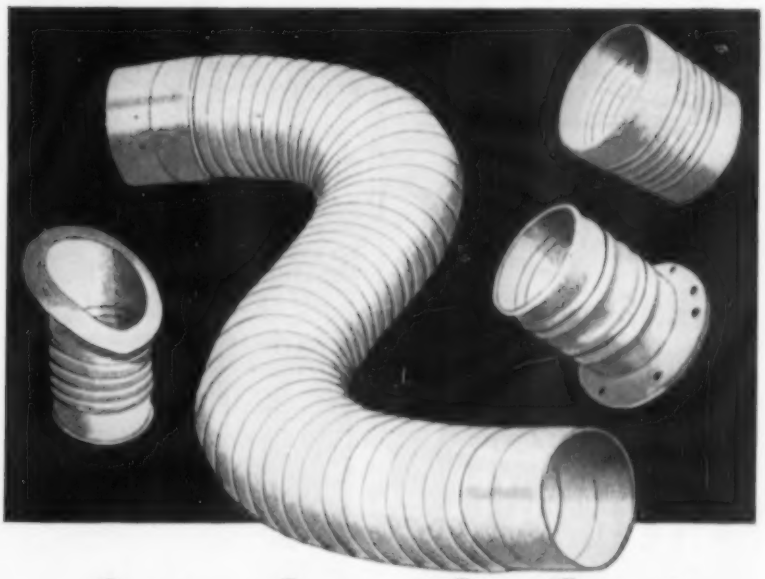


ings weighing up to 7,500 lb. and said to constitute the largest cast aluminum assembly ever produced. The 12¼ ton assembly is 28 ft. long, 130 in. wide and 16 in. deep.

New Eastman 910 adhesive is said to be so strong that one drop placed between two 2-in. steel rods with eye bolts will support 65,000 lb. after it has set in 30 min. Just being put into production by Eastman Chemical Products, Inc., a subsidiary of Eastman Kodak Co., the new adhesive is a cyanoacrylate monomer modified with a

thickening agent and plasticizer. When the monomer is pressed into a thin film between two surfaces, a polymerizing reaction takes place which results in a relatively rapid set. Greatest drawback for aircraft use of the versatile adhesive which will bond metals, rubbers and plastics is that it loses strength rapidly over 212F.

Pacific Airmotive will lay off 250 employes at its Chino facility, where mili-



facts about Flexflyte®

that will help you solve your aircraft ducting problems

What is Flexflyte?
A lightweight, reinforced ducting made of a spring steel wire helix covered with coated fiber glass or a cotton fabric and bound with a fiber glass cord.

What are its applications?
Flexflyte is designed for use with ventilating, defrosting, de-icing and hydraulic systems.

How flexible is Flexflyte?
It will take tight turns at any point up to 180° without buckling. No elbows or fittings are required.

What are its temperature ranges?
From minus 120°F. to plus 650°F.

What about Flexflyte's resistance to abrasion?
It is highly resistant to abrasion, especially when coated with FT-506 which has more than 200 times the abrasion resistance of any tubing of its type and weight.

Is it flame resistant?
Flexflyte has exceptionally high flame resistance and will not support combustion.

What pressures will Flexflyte handle?
Internal working pressures up to 70 psi and external working pressures up to 15 psig, depending on type.

What about installation?
Flexflyte is quickly, easily installed around corners and equipment parts by means of metal clamps. It is also available with special enlarging or reducing ends, either cylindrical, rectangular or polyhedral.

Can Flexflyte be engineered for unusual applications?
Yes, in many special shapes, fabrics, coatings, connections, lengths and diameters. Our special Silicone Department, working with automated machinery, is prepared to meet any requirement for silicone ducting.

How can I make sure that Flexflyte will solve my problems?
Write us, outlining your requirements. Our engineers will be glad to put their experience to work for you. Write Dept. 200.

Represented nationally by Aero Engineering Co. and Airsupply Co., and by Associated Industries in Seattle, Washington.

Flexible Tubing
CORPORATION
GUILFORD, CONNECTICUT • LOS ANGELES 64, CALIFORNIA

BIG or SMALL

they all SHINE BEST
SHINE LONGER
SHINE EASIER with

NEVR-DULL
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The original chemically-impregnated cotton wadding — Cleans quicker, gives higher, longer-lasting gloss, leaves protective film. Saves time, labor and money! Avoid inferior imitations.

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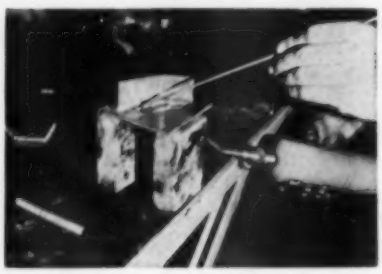
tary IRAN and modification work is performed. Company said layoff results from recent freeze of USAF funds necessary for modification and overhaul.

Stick of InterAct "reaction Eutectic" joins two pieces of aluminum torch-heated to 810F. Maker, Intertectics, Inc., Bedford, O., says that it has developed a method of joining both similar and non-similar non-ferrous metals which is usually stronger than either of the metals involved, frequently



greater in corrosion resistance and with similar electrical, physical and chemical properties. Intertectics predicts a large market for InterAct in the aircraft and guided missile field since it will join aluminum, titanium and copper. On some types of joints, 50%-300% of present joining costs may be saved, the firm says. In operation the material reacts under the presence of heat to eliminate the oxide surface layer and causes the metals to form permanent chemical bonds through ion exchange at temperatures lower than their melting points. Two disadvantages are that since the material is intensely hygroscopic, it must be specially packaged, and as the material is toxic to skin and lungs, the operator must be masked and a water spray exhaust tower system must be used to remove and neutralize fumes.

Douglas Aircraft Co. will start construction of a 126,000 sq. ft. publications center building on a site in the vicinity of Los Angeles International Airport. Section will house company publications work on manuals, training materials and other work formerly accomplished at dispersed locations.

According to AEC appropriations, General Electric's nuclear reactor laboratory at Evendale, O., and Pratt & Whitney's nuclear reactor laboratory at Hartford, Conn., will have $4,350,000 and $1,000,000 respectively for equipment costs and $41,500,000 and $15,700,000 respectively for other operating costs during Fiscal 1958.

Lycoming Div., Avco Mfg. Corp., Stratford, Conn. is separating several hundred employes with the end of licensed production of the R1820 and R1300 piston engines. However, firm may be able to rehire some men back since sales predictions for its T53 and T55 turboshaft engines indicate a need for more personnel.

CIVILIAN AND MILITARY TYPE: PERSONNEL PARACHUTES BRAKE CHUTES TROOP CHUTES CARGO CHUTES
LIFE VESTS LIFE RAFTS SAFETY BELTS ANTI-BLACKOUT SUITS CRASH HELMETS RADIOSONDE CHUTES
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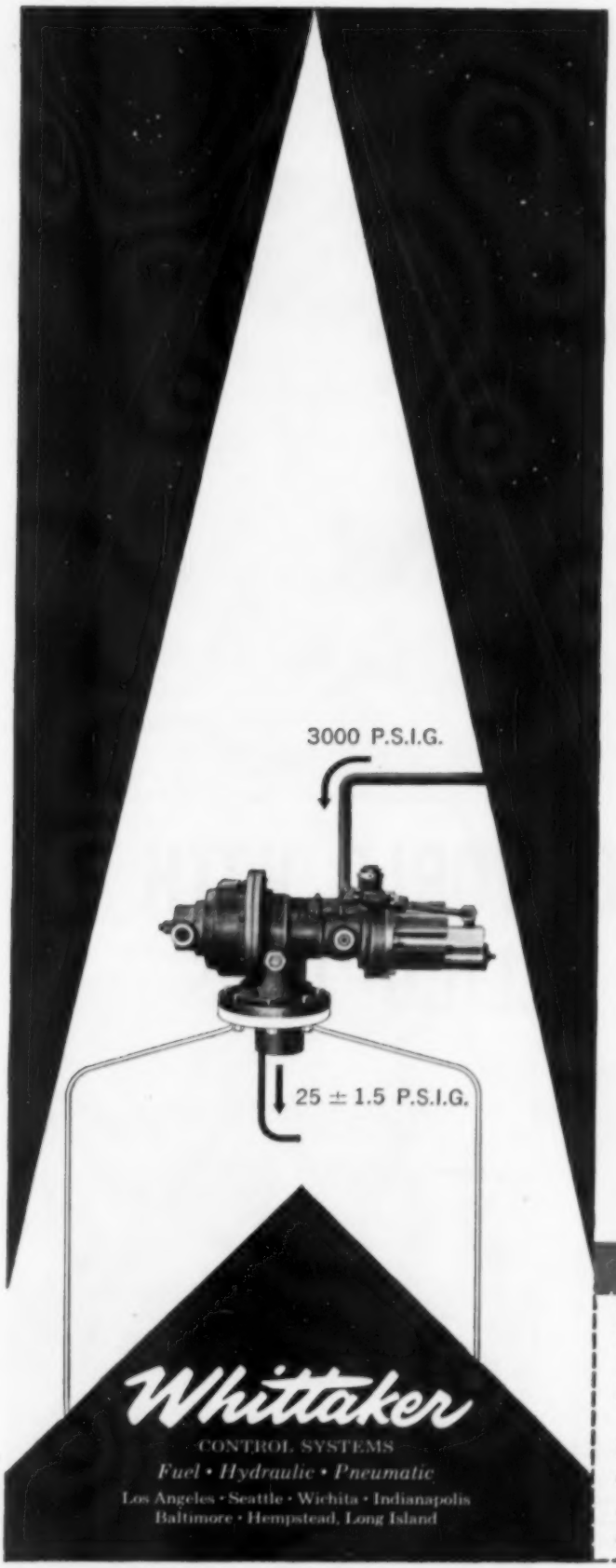
Utility Airline seat

This light-weight aircraft seat was designed for high density transportation of local residents over jungle routes. Seat slings are disposable when damaged and can be replaced at low cost. Labeled TE-570 utility seat, units come in double or triple models and weigh an average of 9½ lb. per passenger place. Manufacturer: TECO, Inc., 3210 Winona Ave., Burbank, Calif.



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This device includes two reducing stages to assure stable operation, regardless of flow variation, and is controlled by a remotely located sense line. This signals the actual pressure in the low pressure line leading from the unit to the tank.

This unit is now installed in one of the latest IRBM's. It is now in production, and with calibration settings changed to provide any specified request pressures, it can be used for many other applications.

This is only one of the many missile problems of all kinds that Whittaker has solved—and *is* solving every day! Whittaker's wide variety of talents are available to you now.

Performance

TEMPERATURE	Ambient, −65°F to +160°F Fluid, −65°F to ±160°F
PRESSURE	Operating (inlet) 3000 PSIG (Outlet) 25 ± 1.5 PSIG pressure, to be maintained in tank Proof 4500 PSIG – Burst 7500 PSIG
SERVICE	Nitrogen or Helium (in the presence of kerosene vapor)

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HEAVY HAULING—Big Sikorsky S-56-type helicopters (Army H-37) have demonstrated many uses, carrying troops, supplies, vehicles and weapons. A big H-37, above, carries a heavy Army truck during recent demonstrations for The Army Aviation Board. H-37s are undergoing rigorous field testing at Ft. Rucker, Alabama.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

TURBINE-POWERED S-58—This turbine-powered Sikorsky S-58 has been flying since the beginning of the year. Built under an experimental Navy program, the test bed is equipped with two General Electric T-58 gas turbines, each rated in excess of 1000 hp. Performance is classified.

SIKORSKYS TO CHILE—With the delivery of four S-55 helicopters, Chile becomes the 23rd nation to operate Sikorsky helicopters. The Chilean Air Force will fly these versatile helicopters in air-sea rescue duty, service in which the S-55 has been conspicuously successful.

HURRICANE WARNING—A day ahead of Hurricane "Audrey," Sikorsky helicopters from the U. S. Coast Guard detachment at New Orleans carried warnings to fishing boats, camps and isolated settlements in the lower Mississippi delta region and around New Orleans. After the hurricane struck the Louisiana coast farther west, the helicopters were assigned to help in the rescue and evacuation work along with Sikorsky helicopters from military services and oil companies. Hundreds of people were flown to safety.

HELICOPTER HISTORY

100,000TH HELICOPTER PASSENGER

On June 15, 1957, Baron Herve de Gruben, *right*, Belgian Ambassador to West Germany, flew from Brussels to Bonn in a Sikorsky S-58 as SABENA's 100,000th helicopter passenger. At his side, *above*, is SABENA's president, M. Willem Deswarte. Not long after, New York Airways flew its 100,000th helicopter passenger. Both lines began scheduled passenger service with Sikorsky S-55s, and have since been equipped with S-58s.

SIKORSKY AIRCRAFT

STRATFORD, CONNECTICUT

One of the Divisions of United Aircraft Corporation

S-58s Land Marines

HUS-type helicopters of Marine Aircraft Group 26 unload troops on deck of USS Lake Champlain as Operation Deep Water begins. Operation entailed air-sea landing off Turkish coast as test of NATO defenses.

AFTER UNLOADING (photo above), helicopters from 2d Marine Aircraft Wing, Cherry Point, N. C., return (below) for more troops.

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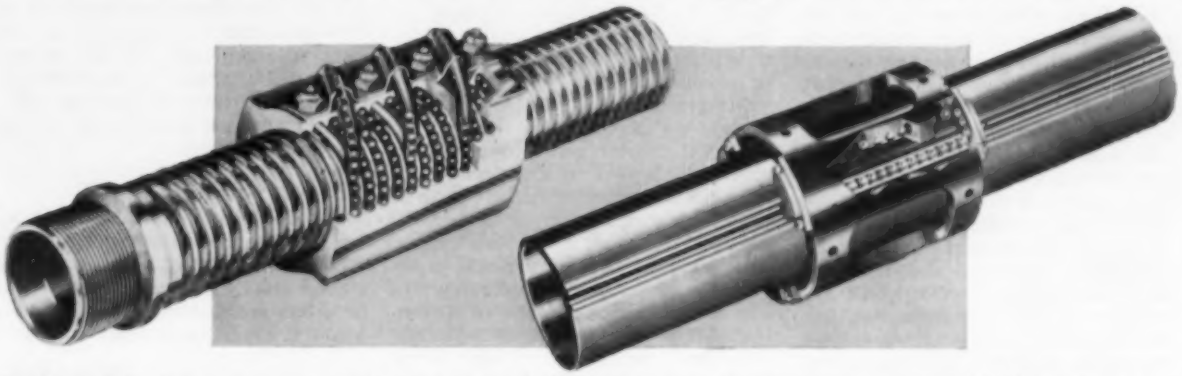
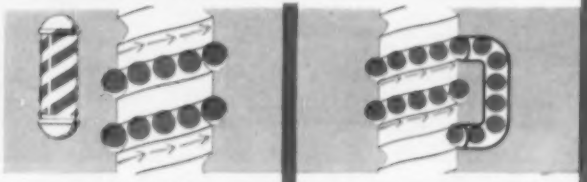
SOLVE ACTUATION and TORQUE PROBLEMS



Saginaw b/b Screws guaranteed 90% efficient —offer 6 major advantages for designers

Available in custom machined and commercial rolled thread types—have been built from 1½ inches to 39½ feet long—⅜ to 10 inches diameter.



Nut glides on steel balls. Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.

At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

1 VITAL POWER SAVINGS. With guaranteed efficiency of 90%, Saginaw b/b Screws are up to 5 times as efficient as Acme screws, require only ⅕ as much torque. This permits much smaller motors with far less drain on the electrical system. Circuitry is greatly simplified.

2 SPACE/WEIGHT REDUCTION. Saginaw b/b Screws permit use of smaller motors and gear boxes; eliminate pumps, accumulators and piping required by hydraulics. In addition, Saginaw b/b Screws themselves are smaller and lighter. Units have been engineered from 1½ in. to 39½ ft. in length.

3 PRECISE POSITIONING. Machine-ground Saginaw b/b Screws offer a great advantage over hydraulics or pneumatics because a component can be positioned at a predetermined point with precision. Tolerances on position are held within .0006 in./ft. of travel.

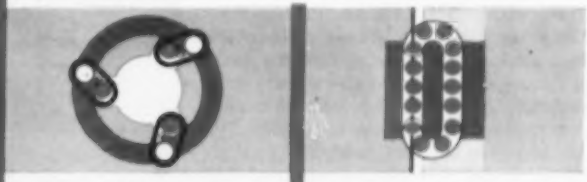
4 TEMPERATURE TOLERANCE. Normal operating range is from −75° to +275° F., but assemblies have been designed in selected materials which function efficiently as high as +900° F. These units are practical where hydraulic fluids have lost efficiency or reached their flash point.

5 LUBRICATION LATITUDE. Even if lubrication fails or cannot originally be provided because of extreme temperatures or other problems, Saginaw b/b Screws will still operate with remarkable efficiency. Saginaw units have been designed, built and qualified for operation without any lubrication.

6 FAIL-SAFE PERFORMANCE. Far less vulnerable than hydraulics. In addition, Saginaw offers three significant advantages over other makes: (1) Gothic arch grooves eliminate dirt sensitivity, increase ball life; (2) yoke deflectors and (3) multiple circuits provide added assurance against operating failure.

Saginaw b/b Splines average 40 times lower friction coefficient than sliding splines

Transmit or restrain high torque loads far more efficiently—have been built from 3 inches to 10 feet long—⅜ inch to 6 inches in diameter.



The Saginaw b/b Spline radically increases the efficiency of transmitting or restraining high torque loads. Instead of sliding against each other, surfaces glide on rolling balls.

The steel balls recirculate in closed circuits formed by mating longitudinal raceways spaced around the circumference of inner and outer splines. Guides return balls.

This revolutionary new kind of spline utilizes the same basic principle pioneered by Saginaw in the ball/bearing screw.

It permits new engineering designs never before practical—literally lets you achieve the "impossible"! In any application where column length must change under torque load, the Saginaw b/b Spline offers greatly decreased friction, less wear, longer life, more dependable operation. It can be fitted with integral gears, clutch dogs, bearing and sprocket seats or a wide choice of other attachments for use with electric, hydraulic or pneumatic units. To convert push-pull to rotary motion, helical types are available with very high leads, ranging from 20:1 to 100:1.

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Saginaw ball bearing Screws and Splines

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Turbojets Are Theoretically Capable of

By J. S. Butz, Jr.

Cleveland, Ohio—Extension of the useful speed of turbojet engines to Mach 4 will provide a much greater latitude in the design of future aircraft than has been expected.

Widening the choice of powerplants will make it easier to optimize 2,600 mph. aircraft for a definite mission requiring relatively great range, or speed, or some other specific performance.

National Advisory Committee for Aeronautics scientists at the Lewis Flight Propulsion Laboratory here believe that current aerodynamic and combustion knowledge indicates that Mach 4 turbojets are feasible. They point out, however, that practical construction of such an engine will require a major research and development effort mainly because of the high temperature performance required of engine components. Mach 2.5 is about the upper limit for present-day turbine engines.

Types of Powerplants

If the Mach 4 turbojet is developed, the powerplants available at that speed will also include turbojets, ramjets, dual-cycle engines, rockets and various combinations of these. The turbojet would retain the advantage it has today. It would be the smallest, least complicated engine installation capable of delivering continuous power to an aircraft through its entire flight. Each of the other engine types will undoubtedly be superior in this speed range for certain missions.

NACA sees Mach 4 as the probable ultimate speed of the turbojet. Ramjets will have rather clear advantages among air-breathing engines above that speed even though they cannot function during landing, takeoff and initial climb.

Overall problem of selecting a powerplant involves many interdependent factors concerning the aerodynamic and structural design of the aircraft as well as the engine. Since it is impossible to separate these considerations, engine studies at Lewis Laboratory include the mutual interaction of the powerplant installation on the airframe.

Hypothetical Case

A generalized example of such a study was presented during a recent Triennial Inspection of the Lewis Laboratory. Thrust requirements of a Mach 4 turbojet over its whole speed range were determined by considering the drag of a hypothetical aircraft representing the most advanced aerodynamic and structural thinking. The aircraft was designed for a speed of Mach 4 at about 85,000 ft. Adequate thrust was stated to be 35% more than the drag, at every speed. This insured good acceleration throughout the speed range. With a smaller thrust margin, excessive amounts of fuel would be consumed during acceleration and the aircraft's range would be seriously reduced.

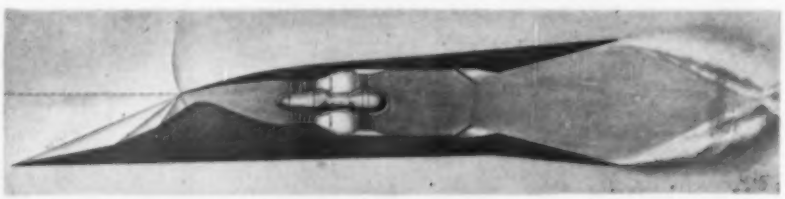
Main value of this example study was to show the importance of the engine's inlet and exhaust nozzle design. The conclusion is that such systems must have variable geometry if the engine is to deliver adequate thrust during the whole flight. Even if the basic engine is capable of delivering much more thrust than the design requirement, it can be rendered inadequate by a poor installation. Thrust losses of the installation are primarily from pressure losses in the air intake system, drag due to inlet flow conditions and shock or overexpansion losses in the exhaust nozzle.

Example study is illustrated on pp. 86-87. Upper figure shows a fixed geometry installation meeting the design conditions of Mach 4 speed at 85,000 ft. The thrust-available curve of this installation superimposed on the thrust-required curve of the aircraft shows that it would be impossible for the airplane to ever accelerate to Mach 4 because thrust is inadequate at the intermediate speeds.

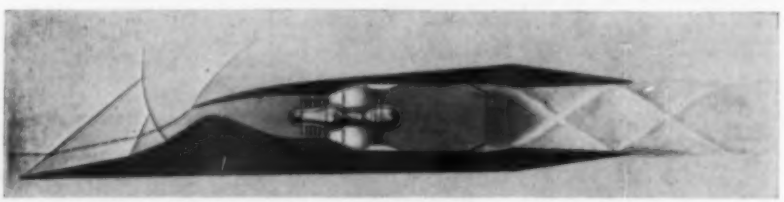
Inadequate Thrust Cause

This inadequate thrust around Mach 2 is primarily due to two things:

- **High drag** caused by air spilling around inlet. Engine requires about 66% less air at Mach 2 than it does at Mach 4. Excess air is deflected around inlet.
- **Overexpansion** of air in exhaust nozzle, causing strong shock waves which slow down exit velocity. Exit area of nozzle, which is correct for Mach 4, is too large for Mach 2.



INSTALLATION above is typical of inlet and exhaust systems for Mach 4 turbojets. It has fixed geometry designed for Mach 4, but so dissipates power at the intermediate speeds that typical aircraft would not be able to exceed Mach 1.5 (right).



DRAWING above shows flow conditions at Mach 2 with a variable geometry exhaust nozzle. Large nozzle expansion ratio is not needed below Mach 2. Nozzle changes alone are not sufficient to make the installation acceptable (right).

FURTHER ADDITION of a variable geometry inlet gives the installation adequate thrust over the entire speed range. Inlet shown here is of the external compression type. Number of possible solutions to the variable geometry problem are being investigated.

Mach 4 Speeds

The next figure shows that using a variable geometry nozzle will still not correct the thrust deficiency around Mach 2, although it will bring subsonic thrust up to the prescribed 35% increase over aircraft drag.

When variable geometry is added to the inlet system the engine and its installation are able to produce the necessary thrust over the whole speed range, as shown in the lower figure.

Variable geometry mechanism of this inlet system would have to include means of varying the angle of the ramps ahead of the duct as well as an efficient by-pass to bleed excess air in the duct to the outside airstream.

Inlet Function

Inlet system shown in this example is but one of those currently being investigated by NACA, other research agencies and aircraft manufacturers. Function of these inlet systems is to slow and compress air entering the aircraft. Air should enter the turbojet's compressors at less than half the speed of sound.

Ideal inlet system accomplishes this diffusion with a minimum loss of total pressure in the air stream and with minimum drag. Both of these losses serve to decrease the effective thrust of the engine.

There are generally two methods for slowing a supersonic air stream. One is an external diffusion system and the other internal. The one used in the previous example was an external system. Both slow the supersonic flow to a low supersonic Mach number by contracting the air stream and then diffusing it to subsonic speed by means of a normal shock wave.

External system generally uses a series of ramps (or cones if the inlet is circular) which create oblique shock waves to slow the air; then the normal shock is located across the mouth of the inlet in the ideal case. Air velocity becomes subsonic across this shock and enters the duct at less than Mach. 1.

Internal System

With the internal system, air enters the duct at supersonic velocity. The duct contracts to a throat where normal shock occurs and the stream becomes subsonic. Duct then expands to slow the subsonic stream.

Trouble arises with the external system when the inlet is too large and more air is taken into the duct than the engine needs. The excess air then spills around the inlet causing a large drag. If the inlet area is too small, the engine sucks the normal shock at the inlet back down the duct causing a decrease in flow density and an increase in pressure loss. Very accurate and sensitive controls are needed to keep the shock pattern and inlet area adjusted so that neither of these two excessive losses will occur.

Trouble with internal systems centers around making the normal shock wave start at the inlet and move down the duct to the throat. This movement of the normal shock depends on the ratio of the inlet area to the throat area. The pressure recovery also depends on this area ratio. Unfortunately, a minimum pressure loss and high duct efficiency demands such a small throat area in relation to the inlet area that the normal shock won't move down the duct to the throat. It stands out in front of the duct, creating a large drag. If the throat is opened up to allow the normal shock to move back to the throat, then a loss in total pressure must be accepted. This type of internal system is also very sensitive to back pressure. If the engine surges or in any way creates a sudden back pressure, the shock may pop out of the duct. Starting the shock back up the duct requires the proper combination of Mach number, back pressure, etc. Sometimes an unstable flow is set up that is difficult to stop.

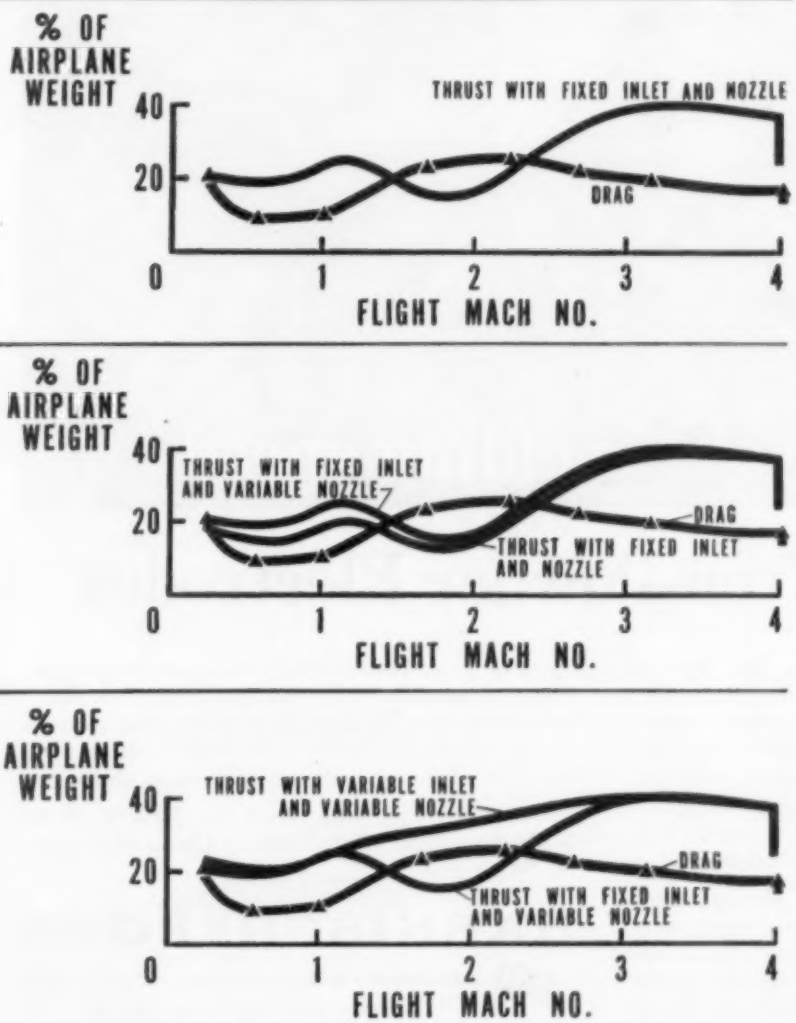
Corrections Devised

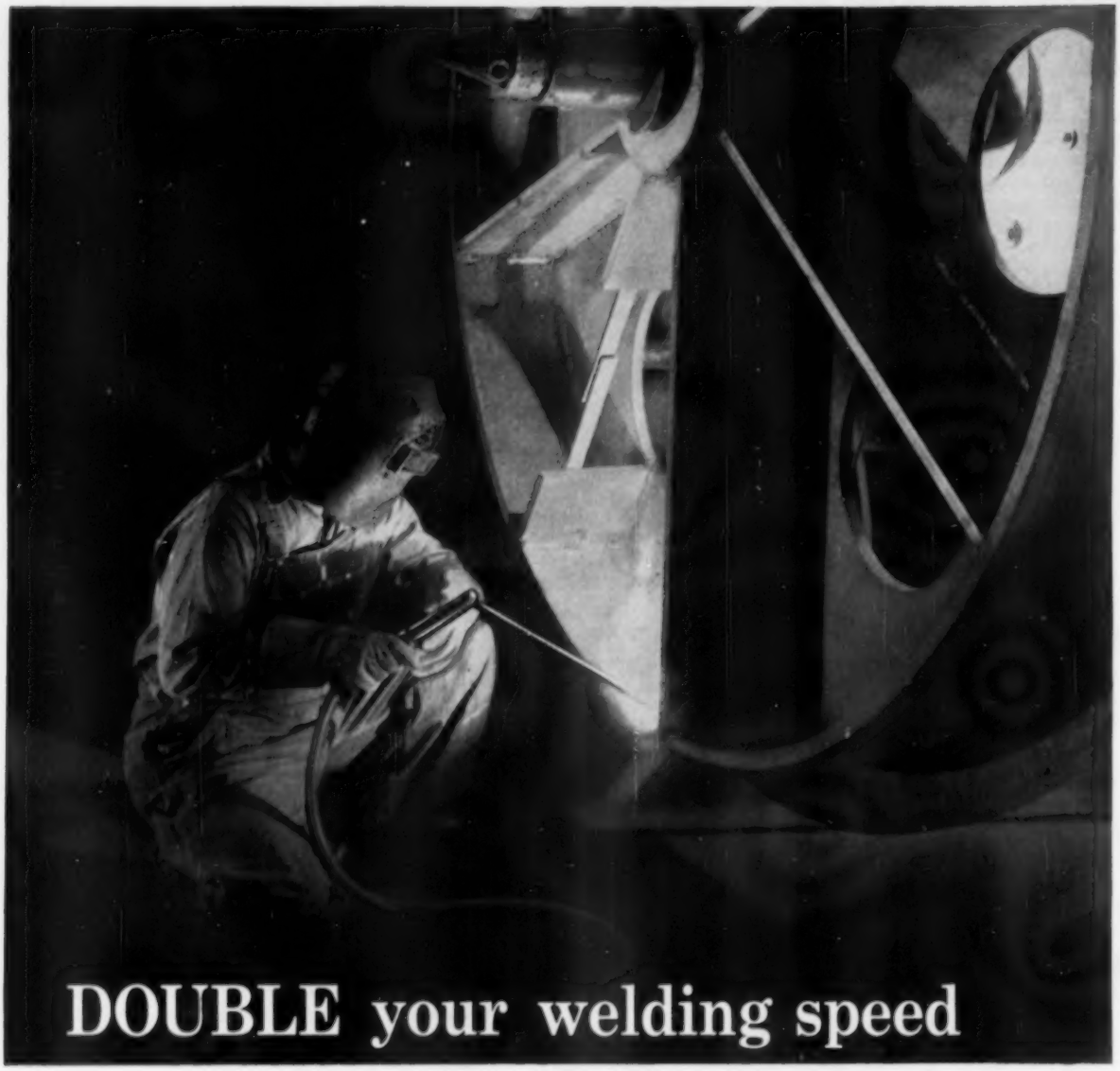
These problems of internal diffusers have been largely corrected. The forward or supersonic portion of the diffusers have been perforated, making the ducts much easier to start and much less susceptible to back pressure.

Variable area throats make the internal ducts capable of operating over a wide Mach number range. Both internal and external systems are being developed and have their enthusiasts.

In addition to having a more elaborate form of variable inlet and exhaust nozzle than current turbojets, the Mach 4 engine will also have a different design in almost every major component.

The compressor will have about three stages instead of 12 to 15 that are on





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NACA scientist holds model of Mach 4 turbojet. Model has cone type variable geometry inlet, three stage compressor, very short combustion chamber and afterburner, and variable area inlet.

some current engines. This is possible because pressure rise per stage has been raised and because much of the compression is accomplished in the inlet duct instead of the compressor.

Better fuels as well as improved combustion design will greatly shorten combustion chambers and afterburner.

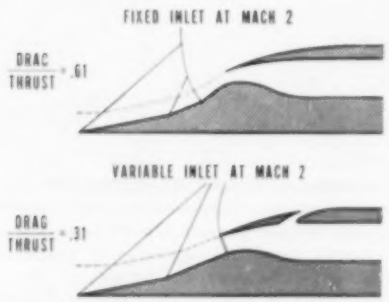
Temperature Comparison

NACA predictions of the temperature within the Mach 4 turbojet illuminate some of the development problems facing the engine. For comparison, the temperatures in a typical Mach 2 engine will be given first:

- **Compressor** inlet–240F
- **Entrance** to combustor–875F
- **Turbine** inlet–1,650F
- **Turbine** outlet–1,000F
- **Discharge** exhaust–3,000F

On the Mach 4 turbojet these same temperatures will usually be:

- **Compressor** inlet–1,230F
- **Entrance** to combustor–1,330F
- **Turbine** inlet–1,450F
- **Turbine** outlet–1,350F
- **Discharge** exhaust–3,300F



TOP sketch shows Mach 4 inlet in Mach 2 flow. Air spills around inlet causing high drag. If spillage air is exhausted behind the inlet (below) drag is reduced.

Temperature Difficulties

Most serious temperature problems will be encountered in the compressor and the main engine bearings and seals. The compressor will require the use of the most advanced alloys now used in turbines to withstand the combination of high temperature and high stress. The turbine on the Mach 4 engine is operated below the turbine temperature of the Mach 2 engine because the stresses in the turbine have been raised to match the aerodynamic capabilities of the compressor.

Environmental temperature of bearings and seals in the Mach 4 engine will be above present limits of such materials because of the heating of the ram air as well as temperatures within the cycle.

NACA studies indicate that the ramjet will be definitely superior to the turbojet above Mach 4. This conclusion is based on the fact that around Mach 3 the turbine begins to extract more pressure from the cycle than the compressor puts in. This detrimental effect of the turbine-compressor unit on the thrust increases with speed. The ramjet obviously doesn't have this handicap and is more efficient above Mach 3.

In terms of a typical military mission however, the turbojet is still competitive up to Mach 4. Using ramjets, the aircraft cruising at Mach 4 can be much smaller than an aircraft with similar range using turbojets. However, the smaller ramjet-powered plane would need some sort of boost arrangement to take off. The weight of this booster would bring the total weight of the ramjet aircraft up to that of a turbojet version, if rockets were used for the boost.

Solid Fuel Engines Increase Reliability

Missiles powered with solid fuel rocket engines are setting new standards for reliability according to two industry announcements.

Lockheed reports that its X-17 three stage research vehicles have flown successfully in over 90% of their firings.

Thiokol Chemical Corp., which developed the first large solid propellant engine claims an even better figure. Thiokol reports that large long range, high velocity missiles with Thiokol engines have completed their flights 97.5% of the time.

These engines were all of the same general size or larger than the one in the RV-A-10 of the Hermes missile program. This missile proved the feasibility of large solid fuel motors. The first stage motor of the X-17 is of the same general size.

About 130 of these large engines have been fired to date. Ninety were static firings and the rest flight tests. Only one flight test failure was partially attributed to the engine.

These high records for reliability are in sharp contrast to the World War II figure of about 30% for all missiles and is indicative of the progress which has been made.

Titan Subcontract Canceled by Martin

Los Angeles—Martin Co. has canceled a contract with Associated Missile Products Corp. of Pomona, Calif., for ground control instrumentation for the Titan intercontinental ballistic missile in production at Martin's Denver plant.

The contract total was $21 million, but it had been largely completed. Martin spokesmen said the termination was in line with an effort to cut costs.

W. L. Congdon, Denver personnel manager for Associated Missile, said the contract cutoff ended the jobs for more than 100 employes in Denver and another 100 in Pomona would be jobless as a result.

Martin said it would continue the ground instrumentation work as the direct responsibility of the Martin firm. Associated Missile started its work here last January.

Martin said the action did not represent any cutback at its plant. "Martin will be able to do the work Associated has been doing," a company official said.

George A. Phillips, author, with General Electric's advanced constant-speed drives. Left, 73-pound, 20-KVA hydraulic constant-speed drive and generator package. Right, 110-pound, 60-KVA turbonator (power turbine and high-speed alternator on a common shaft).

How to Choose the Right Constant-Speed Drive

General Electric engineer outlines method to help determine which constant-speed drive—hydraulic or air-turbine—best suits requirements of particular aircraft

By George A. Phillips, Manager

Systems Engineering, Aircraft Accessory Turbine Dept., General Electric Company

Providing a source of adequate, precisely controlled a-c power—with minimum aircraft performance penalty—is a challenge to the aircraft designer. Electrical loads continue to increase, yet airframes require lighter, smaller, simpler-to-operate power systems with automatic fault protection.

Today, engineers are recognizing the increasing importance of the power drive, and looking closely at the comparative advantages of hydraulic and air-turbine drives.

Both hydraulic and air-turbine drives are reliable, efficient

In general, there are few differences in performance between the two types of drives. Both hydraulic and air-turbine drives offer aircraft a reliable source of constant-speed power. To get *optimum* performance from a particular aircraft, however, the relative merits of each drive system must be carefully matched to the requirements of the plane . . . its mission and power plant characteristics, temperature environment, space and weight

LOCATION IS ONE CONSIDERATION. Hydraulic drive can be mounted directly on engine nose or waist pad with generator (top). Air-turbine drives can be located on engines or in wing or fuselage area (bottom).

limitations, and reliability.

To help aircraft designers select the drive system that will give their planes this optimum performance, General Electric's Aircraft Accessory Turbine Department offers assistance in each of the following steps in the selection process:

1. Establish alternate drive system configurations.

Initial drive system layouts depend upon an analysis of plane configuration, power plant, accessory power needs, and mission including starting and ground handling . . . factors apparent early in the airframe design stage.

At General Electric alternate configurations will be proposed by a group of engineers with broad experience in the design and application of both types of drives, plus a knowledge of electrical system coordination and protection.

2. Study boundary conditions and size components.

Drive system boundary conditions include the input from the power plant, characteristics of the power distribution system, loads into which output is fed, and environmental conditions with particular reference to heat dissipation and cooling. The system analysis includes a thorough evaluation of these boundary conditions and their effect on the design of accessory power system components. Overloads and fault clearing loads imposed by the electrical system, for example, must be matched by a drive which will deliver this output under all required engine operating conditions.

Calling on the IBM 704 computer, General Electric engineers determine maximum fault torques in terms of alternator sequence impedances and type of excitation system. This simplifies the problem of determining the best safe compromise between unbalanced voltage performance with unbalanced phase loading and fault current capability on the one hand and drive and engine penalties on the other.

3. Analyze weight penalty of each drive.

After the several system configurations have been defined, total weight penalty—system's installed weight plus weight of fuel necessary to compensate for power extraction plus drag chargeable to system—then becomes an important comparison basis for drive selection.

To assist the airframe manufacturer in this phase of the selection process, General Electric systems engineers team up with computer technicians to deliver facts and figures on both drive systems. Expected accessory performance, variables in mission profile, load demands, airframe and engine performance, and weight of system components are some of the factors which may be programmed into the IBM 704 electronic "brain."

4. Consider special requirements.

Choice of a system extends beyond quantitative investigation. Special considerations—installation and maintenance, unusual operating requirements, number of power plants and drives, effect of related starting and air-conditioning systems—must be studied carefully. Operating advantages obtainable from each type of system must be evaluated and matched with the particular application before the best drive can be chosen.

. . . and after the right drive is chosen . . .

Developing the prototype, and translating it into proven production models, are tasks that call for broad experience and modern facilities.

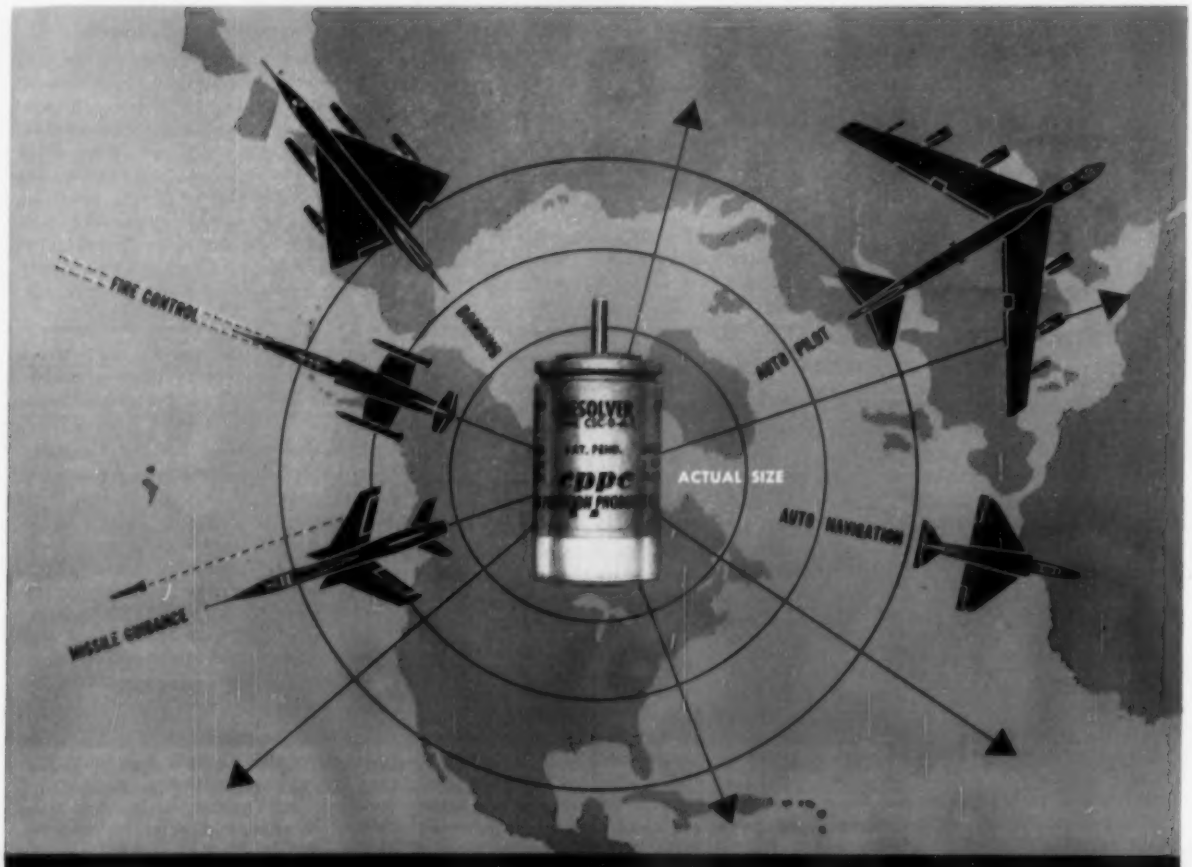
Today, at General Electric, constant-speed drive engineering and development facilities—10 test cells, 65,000 sq. ft. of development floor space, 500,000 sq. ft. of production floor space—are combined "under one roof" at G.E.'s Lynn, Mass., plant. This integration centralizes technical know-how and product versatility . . . and adds up to one more reason why General Electric is qualified to help assure that the *right* choice is made, and the *right* drive produced.

For more information about specific products of the Aircraft Accessory Turbine Dept., check with your nearest G-E Aviation & Defense Industries Sales Office. *General Electric Company, Schenectady 5, N. Y.* 231-15

ANALYSIS performed in early design stages by General Electric engineers is later programmed to IBM 704 computer to help customer select power drive system that best meets requirements of aircraft.

QUALITY REQUIREMENTS of drive components are assured by modern methods and equipment used throughout half-million sq. ft. of production floor space at G.E.'s Aircraft Accessory Turbine Dept.

GENERAL ELECTRIC



IN AVIONIC EQUIPMENT, WHY LOAD ON EXTRA WEIGHT?

use Clifton Precision Size 8 Synchros

WEIGHT 32 GRAMS

SYNCHRO FUNCTION	CPPC TYPE	ROTOR AS PRIMARY: Input Voltage (400~)	Input Current (Amps.)	Input Power (Watts)	Output Voltage (Volts)	Sensitivity (MV/deg.)	Phase Shift (deg. lead)	STATOR AS PRIMARY: Input Voltage (400~)	Input Current (Amps.)	Input Power (Watts)	Output Voltage (Volts)	Sensitivity (MV/deg.)	Phase Shift (deg. lead)	D.C. RESISTANCE: Rotor (Ohms)	Stator (Ohms)	IMPEDANCE: Zro (Ohms)	Zso (Ohms)	Zrs (Ohms)	Max. Null Voltage (MV)	Max. Error (Min.)
Torque Transmitter	CGC 8 A 7	26	100	5	11.8	206	8°	—	—	—	—	—	—	37	12	54 + j260	12 + j45	80 + j20	30	7
Control Transmitter	CTC 8 A 1	—	—	—	—	—	—	11.8	090	2	23.5	410	9°	150	24	212 + j684	22 + j115	246 + j60	30	7
Control Transformer	CTC 8 A 4	—	—	—	—	—	—	11.8	029	.08	22.5	390	8°	389	64	560 + j1860	90 + j340	640 + j190	30	7
Torque Receiver	CRC 8 A 1	26	100	5	11.8	206	8	—	—	—	—	—	—	37	12	54 + j260	12 + j45	80 + j20	30	30 oz.
Electrical Resolver	CSC 8 A 1	26	038	.42	10.8	190	20°	11.8	078	.26	23.2	400	11°	230	27	286 + j620	45 + j148	350 + j75	30	7
Electrical Resolver	CSC 8 A 4	26	038	.42	26	454	20	26	030	.23	21.5	375	12°	230	170	286 + j620	250 + j830	350 + j75	30	7
Control Differential	CDC 8 A 1	—	—	—	—	—	—	11.8	085	.21	11.8	206	9°	36	25	38 + j122	27 + j120	48 + j14	30	7
Vector Resolver	CVC 8 A 1	26	.057	.34	11.8	206	10.2°	—	—	—	—	—	—	78	27	103 + j440	8 + j30		30	7

LOOK TO CPPC FOR SYNCHRO PROGRESS

CLIFTON PRECISION PRODUCTS CO. INC. cppc Clifton Heights, Pa.

PLASTIC bubble protects camera mounted on nose of GPL's DC-3 flying laboratory.

MONITOR shows picture of starboard landing gear in down position. Picture could be used to estimate moment of touchdown in cross wind landing.

TV May Provide Airliner Inspection

By James A. Fusca

New York—Use of closed circuit television for inflight inspection by pilots of landing gear, wing and tail assemblies is being studied by at least one major airline. If cost is found to be justifiable, use could be extended to include individual inspection of engines and control surfaces from the cockpit.

Equipment proposed for this use is rugged 400 cycle camera and monitor developed by General Precision Laboratory, Inc., Pleasantville, N. Y., for military use under extreme environmental conditions. General Precision has installed and demonstrated the equipment in a DC-3 flying laboratory equipped with cameras to show how the above functions could be presented on a single monitor with selective switching.

Present study is being conducted by American Airlines which is considering an installation of two cameras on an experimental basis in one of the ten Convairs recently withdrawn from service. Mounting and functions of the cameras would be as follows:

• **Vertical tail fin.** Forward-looking camera mounted on the vertical tail fin might solve the anticipated problem of spotting ice runback on the Lockheed Electra and Boeing 707. American says pilot will not have full surveillance of wings either from cockpit or the cabin in the Electra and they can be surveyed only with difficulty in the 707.

• **Tail skid.** Camera mounted near the tail skid and looking forward could assist the pilot in minimizing stress on the landing gear assembly in crosswind landings by showing vertical distance to touchdown. American feels that crosswind landings necessitated by the use of preferential runways increases maintenance cost on landing gear structures, brakes and tires. Possible solution would be for the camera to enable the pilot to judge just before touchdown the moment in which to take his aircraft out of a wing-low or crabbed attitude.

DC-3 being used by General Precision for demonstration of its closed circuit TV equipment mounts four cameras whose pictures can be shown on cabin monitors successively by selective switching. Camera positions are:

• **Bottom nose.** Camera mounted under the nose shows position of star-

NOSE camera inside bubble, showing belts for controlling iris and focus settings.

CAMERA viewing vertical tail fin and port horizontal stabilizer is shown mounted in clear plastic bubble just aft of passenger loading door.

DOES YOUR INTERCOM HAVE "FAT" BETWEEN THE EARS?

To meet the concepts of today's and tomorrow's supersonic jet aircraft problems, intercoms have undergone extensive systems evaluations to remove the "fat".

A case in point: Andrea research engineers have devised a material improvement in intercom systems embodying all factors . . . weight, reliability, form factor, simplicity, performance . . . for the military establishment. *This is just one example* of how Andrea Radio Corp., with some of the best brains and facilities in the industry, can augment your organization in solving a wide range of electronic problems.

Imagination, ingenuity, industry—that's the "bible" at Andrea, a company known to all departments of defense for consistent top level quality performance in engineering and production of advanced electronic design.

Andrea has the resources and manpower to help *you* solve your defense electronic problems. Simply write on your letterhead to:

SYSTEMS DIVISION **Andrea** RADIO CORP.
Long Island City 1, N. Y.

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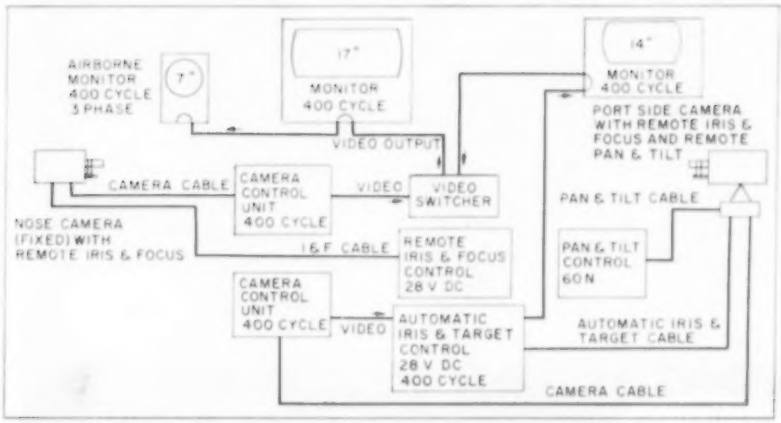

AIRBORNE MONITOR 400 CYCLE 3 PHASE
7"
17"
MONITOR 400 CYCLE
14"
MONITOR 400 CYCLE
PORT SIDE CAMERA WITH REMOTE IRIS & FOCUS AND REMOTE PAN & TILT
VIDEO OUTPUT
CAMERA CABLE
CAMERA CONTROL UNIT 400 CYCLE
VIDEO
VIDEO SWITCHER
PAN & TILT CABLE
NOSE CAMERA (FIXED) WITH REMOTE IRIS & FOCUS
I & F CABLE
REMOTE IRIS & FOCUS CONTROL 28 V DC
PAN & TILT CONTROL 60 N
CAMERA CONTROL UNIT 400 CYCLE
VIDEO
AUTOMATIC IRIS & TARGET CONTROL 28 V DC 400 CYCLE
AUTOMATIC IRIS & TARGET CABLE
CAMERA CABLE

BLOCK DIAGRAM of a two camera, two monitor airborne closed circuit television installation such as is in GPL's DC-3 "flying laboratory."

board landing gear, also aids in judging touchdown. Camera is enclosed within a protective plastic housing and mounted fixed to the skin of the fuselage.

• **Aft fuselage.** Second camera is mounted on the upper portside fuselage just aft of the passenger door. This camera provides close-up pictures of the vertical fin and port horizontal stabilizer, including de-icing equipment. Camera is mounted in a clear plastic bubble.

• **Cabin.** One camera is swivel-mounted at one of the cabin ports to demonstrate use of the camera for inflight ground surveillance.

• **Belly.** Fourth camera is mounted in the belly, directed straight down through a clear circular port. In this position, it is used to view check points in tests and demonstrations of General Precision's self-contained navigation systems.

Further Work

General Precision is exploring the possibility of using the weather radar scope currently in the cockpit of many commercial aircraft for presentation of its TV picture. The pilot would then be able to switch his scope from radar to television at his convenience. Indications to date are that the problems are too difficult to be solved in an economically acceptable fashion.

Primary problem is that a radar scope is designed for rotating scan and moderately rapid image decay while television requires horizontal scan with slow image decay. As an alternative solution, General Precision is considering development of a small 3 in.-scope monitor that would minimize problems of installation in already overcrowded cockpits.

Developed for use under extreme environmental conditions, General Precision's ruggedized camera presently is in use for flight testing, rocket and jet test stands, wind tunnels, and military ground and air systems.

Features of the camera that GPL says make it attractive for this application include:

• **Both optical focus** and iris aperture could be controlled from the cockpit.

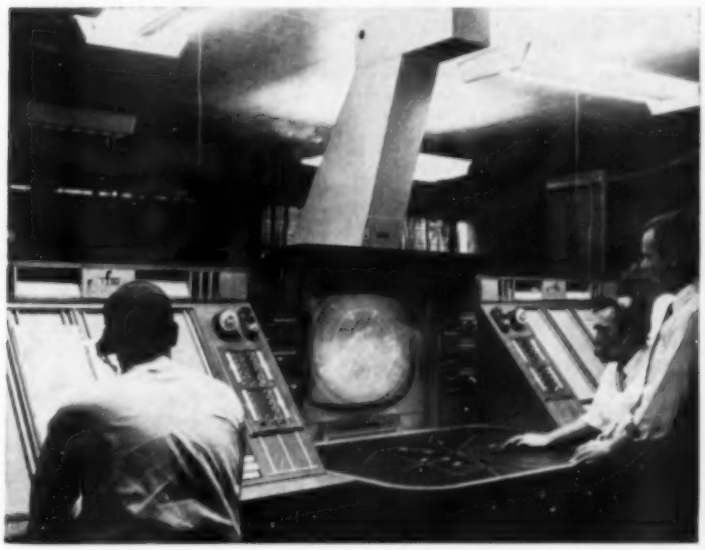
• **Camera will operate** satisfactorily under 15G shocks, 100% humidity, ambient noise levels above 175 db. under temperatures between −30 and +60C, and at altitudes up to 100,000 ft.

• **Weight of camera,** 6.5 lb., control unit 35 lb.

• **Resolution** of 500 lines for 525 line system, 60 fields interlaced.

Monitor System

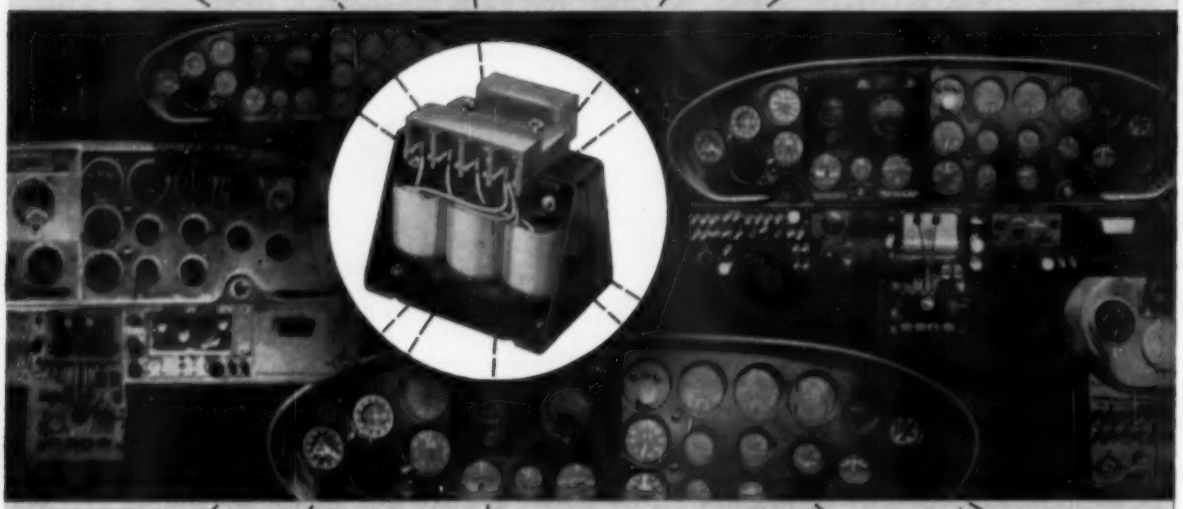
Although the camera can be used with conventional industrial closed circuit monitors (modified to operate from aircraft's 400 cycle airborne power supply), General Precision anticipates use of a special 7 in. airborne monitor designed originally for the Air Force. Unit is designed to meet MIL specs,



CAA Tests Control Equipment

Combined radar, aircraft identification and airways layout (left) can be displayed in high-ambient light area by superimposing televised picture of controller's working table on radar screen. Procedure is French development called SPANRAD, being tested at CAA's Technical Development Center at Indianapolis. CAA is service testing automatic computation of flight plans and machine printing of flight progress strips (right) as a first step toward automatic data processing of air traffic control information. Controller is receiving flight plan by telephone and entering information on punched card.

behind these panels



smaller, lighter, cooler Westinghouse transformers for each function of every aircraft A-C system

Constant, dependable power is a must for lighting, instruments, controls, rectifiers, window-heating, and other functions in commercial and military aircraft A-C systems. Combining full power ratings with minimum size and weight, the Westinghouse aircraft power transformer provides efficient control of this distribution voltage.

Reduced size and weight is achieved by a combination of Class H insulation and continually improved Westinghouse grain-oriented Hipersil® steel for cores.

Easier installation and maintenance are assured by molded terminal boards and covers. This feature provides an additional weight reduction, too.

Peak cooling efficiency results from the open-type construction, which also eliminates weighty housings and filling compounds.

This transformer meets all environmental, overload, regulation and efficiency requirements of Air Force Specification MIL-T-9219, as well as the most rigid individual requirements. It is rated at 1½-kva, 3-phase, 380-420 cps, 200/115 volts, full load.

Contact your Westinghouse representative, or write Westinghouse Electric Corporation, Specialty Transformer Department, P. O. Box 231, Greenville, Pennsylvania.

J-70827

YOU CAN BE SURE...IF IT'S

Westinghouse

is shock mounted, and uses a 7 in. circular screen. Disadvantage would be cost of about $6,600 compared with about $300 for the industrial type.

The 7 in. airborne monitor has a resolution of 450 lines, weighs 42 lb., without mounting, and has a specified minimum life of 1,000 hr. at 50 C.

FILTER CENTER

▶ **Diode Converter With Gain**—Semiconductor diode-type frequency converter, which also provides useful amplification, has been developed by Bell Telephone Laboratories. Most promising results to date have been achieved with up-converter, in which gold-bonded germanium diode converts 75 mc. to 6,000 mc., providing gains as high as 6 db. with "adequate bandwidth." Up-converter does not amplify in reverse direction, can be made with large active areas to increase power-handling capacity. Conversion gains as high as 45 db. have been obtained with diffused silicon diode down-converters. Down-converters have relatively poor isolation between input and output, but Bell believes that use of non-reciprocal ferrite devices may get around this disadvantage.

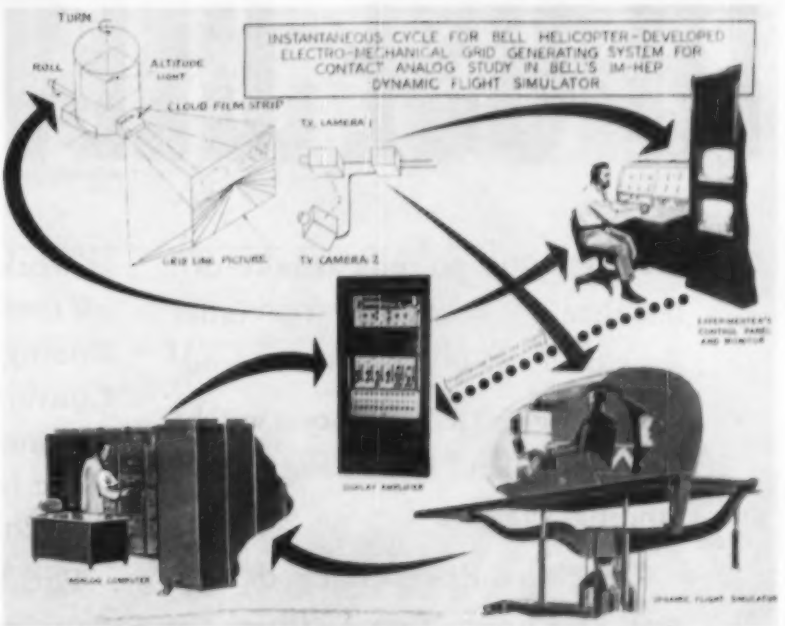
▶ **Silicon Transistor Prices Drop**—Texas Instruments has cut prices of its silicon transistors by as much as 22%, and prices of silicon glass diodes by 35%. This is the second silicon transistor price cut made by the company during 1957.

▶ **AGCA With Voice**—Gilfillan is flight testing new version of its automatic GCA (AGCA) which uses voice data link instead of pulse-coded data link, opening way to its use by military and civil aircraft equipped only with conventional communication receivers. First flight tests, made Sept. 29, reportedly were "very successful."

▶ **CAA Buys More En Route Radar**—Civil Aeronautics Administration has placed $4.1 million contract with Raytheon for four more long-range traffic control radars plus Amplitrons (high-power microwave amplifiers) to boost range of 10 of 23 en route radars

Analog Device For Helicopters

Contact analog device which displays an artificial picture of the ground to aid helicopter pilots in day, night all weather flying is being developed by Bell Helicopter Corp. Bell has helicopter part of the Army-Navy Instrument Program (ANIP) under a contract with the Office of Naval Research (AW Oct. 21, p. 34). Pictures show helicopter flight simulator being developed in conjunction with the contact analog display. Object is to enable pilot with only 20 hours flight instruction to fly a helicopter under all weather conditions.


INSTANTANEOUS CYCLE FOR BELL HELICOPTER-DEVELOPED ELECTRO-MECHANICAL GRID GENERATING SYSTEM FOR CONTACT ANALOG STUDY IN BELL'S IM-HEP DYNAMIC FLIGHT SIMULATOR
TURN
ROLL
ALTITUDE
CLOUD FILM STRIP
TV CAMERA 1
GRID LINE PICTURE
TV CAMERA 2

THE CONVAIR 880 IS THE

TO USE CLEVELAND

Over 175,000 pounds at take-off, less than 4½ hours and 3000 miles later, over 125,000 pounds to land!

Convair 880 jet transports will be using Cleveland Pneumatic AEROL landing gears.

Cleveland Pneumatic's design, test, and production facilities are at work now on landing gears for *all three* American jet transports—Boeing 707, Douglas DC-8, and Convair 880. Since 1926 Cleveland Pneumatic has developed and built more landing gears for more aircraft than any other manufacturer.

Put our experience and plant to work on your next aircraft project.

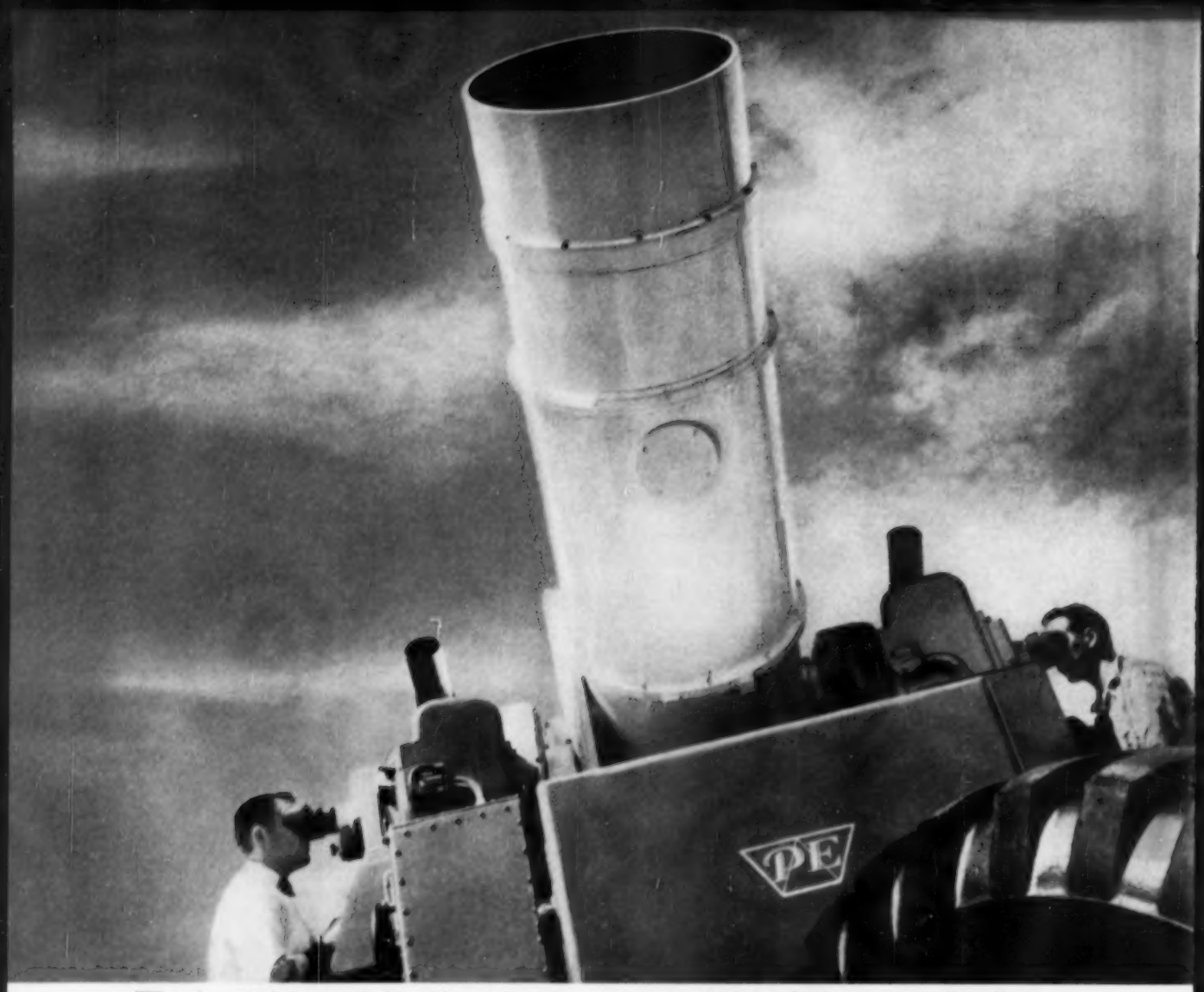
PNEUMATIC GEAR

A JOB AT CLEVELAND PNEUMATIC offers many benefits for qualified engineers—liberal profit-sharing, good wages and fringe benefits, stability assured.

Write today, outlining your qualifications.

CLEVELAND PNEUMATIC

TOOL COMPANY • CLEVELAND 5, OHIO



TPR is the nation's first completely mobile optical missile tracking system. Developed by Perkin-Elmer, the instrument is capable of photographing an object smaller than a baseball at more than 20,000 feet. The instrument records on film a missile's speed and altitude during its entire flight. Additional data can then be derived for aerodynamic analysis.

The bird watchers

recording telescopes developed by Perkin-Elmer will follow missiles going 10,000 mph.

The "birds" hatched by the Air Force missile program fly fast—some moving at better than 10,000 miles an hour within seconds after takeoff. To track these experimental missiles in the field, Perkin-Elmer designed and built TPR (Telescopic Photographic Recorder)—a mobile 100 – 200 – 300 inch focal length tracking telescope synchronized with two sighting telescopes, a camera unit and a complex electronic control system, all mounted on a specially modified four-wheel gun mount.

In developing TPR, Perkin-Elmer drew on years of experience gained in designing some of the world's finest large optical systems. New missile-tracking instruments and complete installations, both mobile and fixed, are being built in quantity by Perkin-Elmer.

In integrating optics with electronics and mechanics, Perkin-Elmer offers unmatched capability. P-E's staff and unique production facilities may well hold the answer to *your* systems problems. For information, write Perkin-Elmer Corporation, 770 Main Avenue, Norwalk, Conn.

Air-to-air missile of the type which will be tracked by Perkin-Elmer's TPR.

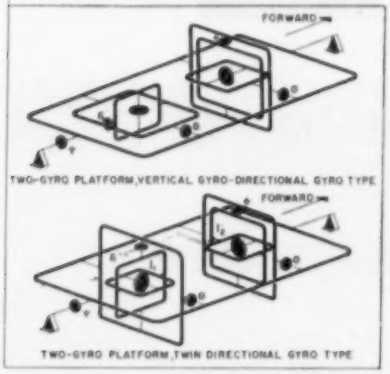
ENGINEERING AND OPTICAL DIVISION

Perkin-Elmer *Corporation*

NORWALK, CONNECTICUT

previously ordered by approximately 68%. Four new radars, slated for initial delivery in about a year, will be installed at Chillicothe, O., Salem, Ore., Montgomery, Ala., and Minneapolis, Minn. First Amplitron will be installed on radar at Washington, D. C., to be followed by installation at Boston, Los Angeles, Pittsburgh, Seattle, Miami, Denver, Salt Lake City, Oakland and Atlanta.

▶**Novel Stable Platform**—Lightweight twin-gyro stabilized platform which uses two "directional" gyros instead of conventional directional and vertical gyros has been developed by Sperry Rand for Wright Air Development Center. Twin non-floated directional gyros, mounted with spin axes horizontal and at right



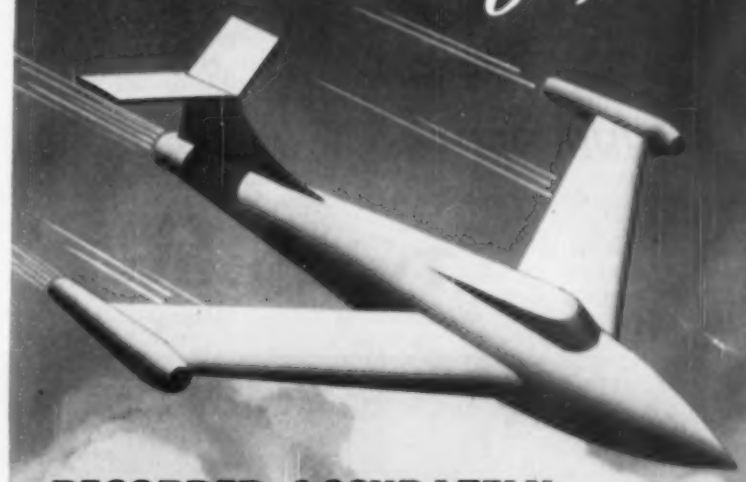
angles to one another, give what Sperry says is "unprecedented accuracies in heading information and all-attitude flight." Random drift rates are quoted at ½ deg. per hour in heading and 0.1 degree per minute about vertical axis, without magnetic or vertical slaving. Entire stabilized platform, including amplifiers, weighs only 26 lb.

▶**Unintentional Oversight** – Philco Corp. reports that it has been performing traffic control evaluation programs with its own funds for some time. Company was not included among those listed as having ATC data processing study programs under way. (AW Sept. 30, p. 29.)

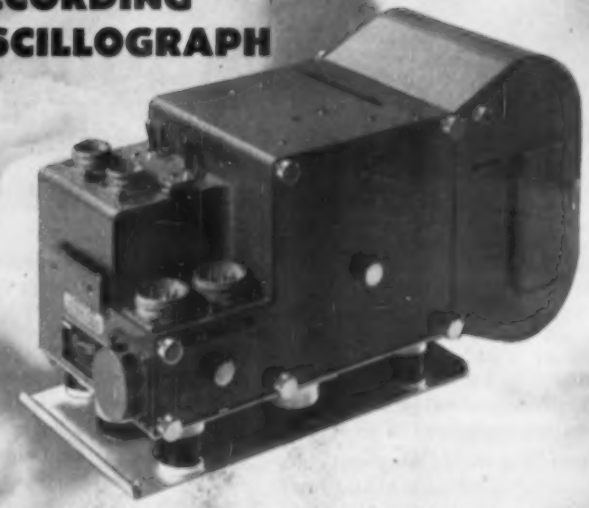
▶**PAA Buys Airborne Loran**—Pan American World Airways has ordered 53 airborne Loran receivers from Edo Corp., College Point, N. Y., for installation on new fleet of Douglas DC-8s and Boeing 07s. Small, lightweight Model 345 Loran is designed for cockpit installation for use by pilot and copilot, weighs 29 lb.

▶**AF Builds Infrared Range**—Airborne infrared reconnaissance systems will be evaluated on new test range recently completed at Eglin AFB, believed to be the first of its type. Facility includes provision for testing target resolution,

STABILITY *in flight*



RECORDED ACCURATELY By Century Model 409 RECORDING OSCILLOGRAPH



The Century Model 409 Oscillograph was designed for operation under the most adverse conditions, especially where space and weight considerations are limited. It is a miniature, compact unit incorporating many features found in larger models. Records faithfully during accelerations and shock in excess of 20 G's. Its size and capacity make it especially desirable for use in missile launching, parachute seat ejection, flight test of helicopter and fighter aircraft and torpedo studies.

Century Electronics & Instruments, Inc.

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Progress with **TITANIUM**

Announcing...

Two new Titanium alloys for high temperature applications

MST 821... *the highest strength weldable sheet & bar alloy in 400—1000°F range*

MST 2.5Al-16V... *the first readily formable, heat treatable sheet alloy*

Two new alloys developed by Mallory-Sharon now extend the high temperature usefulness of titanium.

MST 821 is a weldable sheet and bar material with exceptional high temperature strength. It offers strengths equivalent to similar titanium alloys at temperatures *two hundred degrees* higher, in the 400 to 1000°F range. MST 821 is thermally stable, and has good ductility and formability.

MST 2.5Al-16V was developed in response to needs of the airframe industry for a sheet alloy which would be soft and formable in the annealed condition, and which could be heat treated, after forming, to high strengths while retaining ductility. With this material, yield strength can be as low as 50,000 psi, to permit easy fabrication, then increased to 150,000 psi by heat treatment. Age hardened sheet has good short-time hot strength—about 100,000 psi yield strength up to 800°F.

These alloys, now in limited commercial production, are further evidence of rapid advances in titanium. Use Mallory-Sharon's outstanding technical experience and service on your present requirements—or future plans—in titanium.

MALLORY Ti **SHARON**

MALLORY-SHARON TITANIUM CORPORATION · NILES, OHIO

Producers of titanium and titanium alloy sheet, strip, plate, rod, bar, billets

temperature differential sensitivity and absolute sensitivity.

First system tested was the AN/AAR-9 infrared recon system; six more systems are slated for test during coming year.

► **Boeing Studies Radiation Effects**—Boeing Airplane Co. currently is studying effect of nuclear energy on transistor performance and life to determine vulnerability of Bomarc (IM-99) missile's avionics to radiation from atomic explosion. Tests are being conducted near atomic pile at both Arco, Idaho, and Los Alamos, N. M.

► **Radome for 1,000F Temperature**—Development of new inorganic laminate for radome use at temperatures of 1,000F, with higher strength-to-weight ratio than currently used ceramic dielectrics, is objective of new Wright Air Development Center contract awarded to Horizons, Inc., Cleveland. Another contract calls for development of coating technique to prevent oxidation of niobium at 2,500F temperature.

► **On The Dotted Line**—New contracts recently announced by avionics manufacturers include:

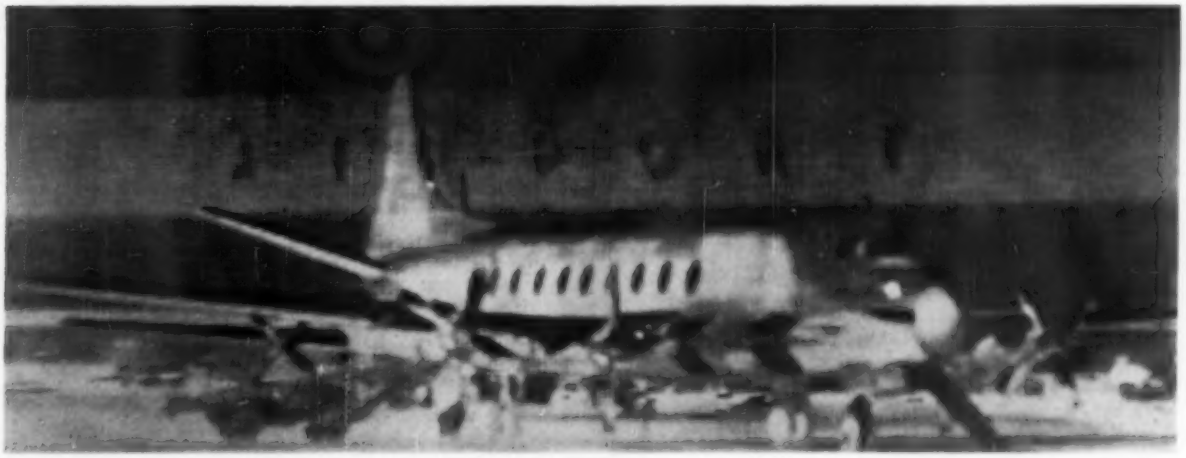
• **Bendix Radio** automatic direction finder, DFA-70, will be used in dual installations on Air France fleet of Caravelle jetliners.

• **Cossor Radar & Electronics Ltd.** has received contract from Luxembourg Ministry of Transport for dual installation of its GH-21 surveillance radar, including two remote radar display units.

• **Systems, Inc.**, Orlando, Fla., has received contract for research and development in the field of missile guidance radiating systems from Wright Air Development Center.

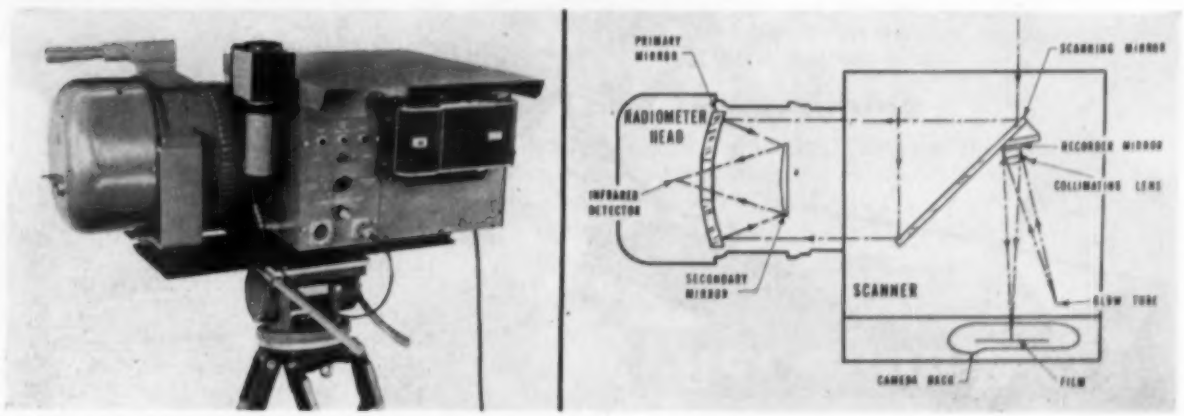
• **Marconi's Wireless Telegraph Co. Ltd.**, Chelmsford, England, will supply two 500 kw. surveillance radar systems to New Zealand Civil Aviation Administration. One of the radar systems will be installed at Wellington, N. Z., to serve the Cook Strait Zone and Rongotai Airport, the other at Ohakea air force base.

► **Lightweight Doppler Navigator**—Ryan Aeronautical reports new Model 108 Doppler auto-navigator, called "the lightest in flight use by any of the military services," has been installed on an Army L-20 for flight evaluation at Army Electronic Proving Ground, Ft. Huachuca, Ariz.



Infrared Camera Detects Variation Of Temperature

Infrared photo of Viscount (above) taken mid-afternoon on sunny day shortly after landing, shows relative temperature of different portions of aircraft by brightness or darkness on the photo. Windows are cold (dark) because of air conditioned cabin. Engines and top of fuselage are comparatively cool. Belly is warm because of infrared energy radiated from concrete apron. Infrared camera (below) produced by Barnes Engineering Co., contains scanner mirror which moves in synchronism with infrared detector scanner, reflecting point source of visible light from glow tube onto film of Polaroid camera to produce photo shown above. Infrared camera can be used to inspect metal honeycomb, detect faulty welds and overheating of machine parts.

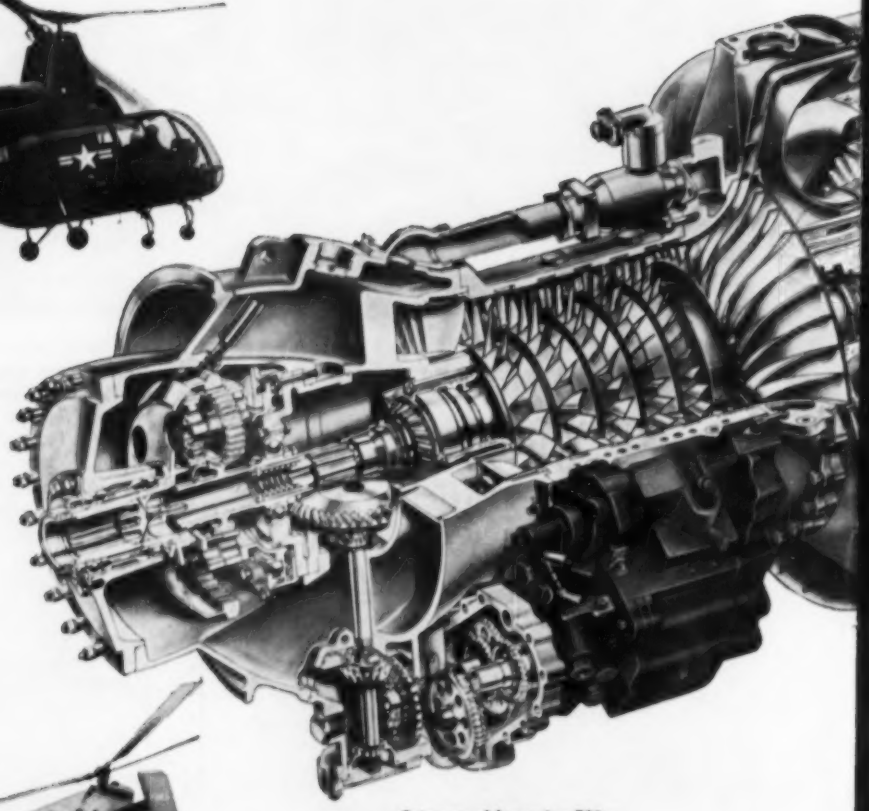


Lycoming's T53

PROVEN . . .

Low-cost T53 Registers More Hours Of Flight

Kaman H-43B



Cutaway of Lycoming T53

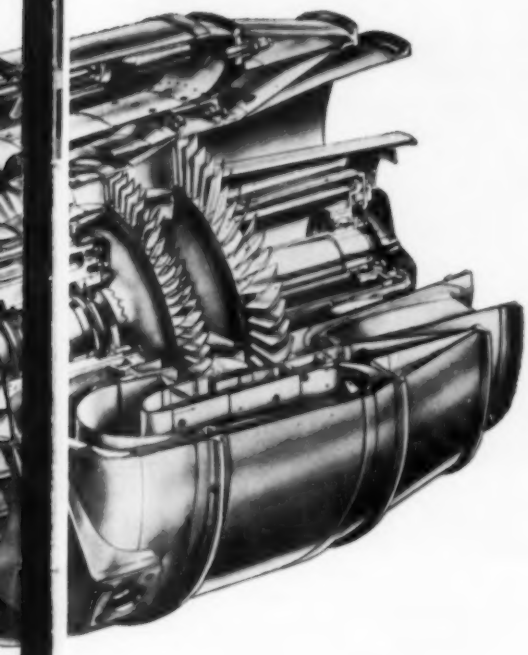
Vertol Model 105

Grumman Model AO-1

Bell H-40

IN FLIGHT

Time Than Any Other Comparable Turbine!



Its remarkably low production costs is but one reason why 6 major aircraft companies have selected the T53. Installed in the Bell H-40 and Kaman H-43B helicopters, the T53 has already earned a reputation as an engine "You can kick" and "Don't need to baby in flight." In addition, the T53 was chosen to power Grumman's new AO-1 High-Performance Observation Airplane as well as Vertol's Model 76 tilt-wing aircraft and Model 105 helicopter, a turbine-powered version of the H-21. The Ryan Model 92 and Doak Model 16 research aircraft—now being readied for flight—will also use the T53. In flying time experience, the T53 has recorded *more hours* than any other turbine engine in the same power class!

Built under the sponsorship of the U. S. Army and the U. S. Air Force, the low-cost T53 has also been installed in a power package for a high-speed U. S. Navy boat. Its easy adaptability to all sorts of applications has therefore been proven in practice.

Right now, the T53 helicopter version offers 825 s.h.p., but that rating will increase to over 1,000 s.h.p. in the foreseeable future. The current turbo-prop version delivers 1,005 e.s.h.p. from a compact 47.6″ length x 23″ diameter. The T53 operates on a number of fuels, including automotive and aviation gasolines and JP-4. Now nearing full production, Lycoming's T53 is designed especially for safety, durability, easy maintenance, as well as high power with low weight. Perhaps it can solve your future problems now!

Vertol Model 76

Look to Lycoming

For further information, write to: Lycoming Division, Avco Manufacturing Corporation, 550 South Main Street, Stratford, Connecticut.

AVCO Lycoming

Admiral

KEEPS AERIAL CAMERAS STABLE AS A BILLIARD TABLE...

ADMIRAL'S PALO ALTO LABORATORY DEVELOPS EQUIPMENT FOR CAMERA STABILIZATION

The art of aerial photo-reconnaissance requires absolute camera stability to obtain the fine detail needed to discern small objects from great altitudes. Even with an automatic pilot in control, the plane itself is far too unstable for reconnaissance work, and additional stabilization is required.

Now Admiral has developed equipment that automatically compensates for the slightest deviations. Electronic signals from gyros are appropriately modified and distributed as needed to stabilize each of the various camera mounts. The accuracy of the gyro signals is fully reflected in the mechanical adjustments of each camera platform. Moreover, Admiral has applied subminiaturization techniques to reduce size and weight to half of the original requirement specifications.

This system was developed in Admiral's Palo Alto Laboratory by the Advanced Development Section, Government Laboratories Division. Complete information concerning the Laboratory's capabilities and current activities is available to qualified persons.

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ENGINEERS. The wide scope of work in progress at Admiral creates challenging opportunities in the field of your choice. Write Director of Engineering and Research, Admiral Corporation, Chicago 47, Illinois.

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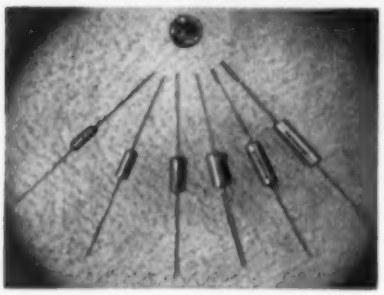
Components & Devices

• **Pressure pickup,** Type 4-317, is available in gage pressure ranges to 5,000 psi, and can be operated continuously at 5.0 volts maximum input from −350 to +600 F with transients to +750 F. Allowable acceleration is 100 Gs on any

axis. Linearity and hysteresis deviation combined are less than ±1.5% of full range output. Unit is ⅜ in. in diameter, ¾ in. long, and weighs 30 grams. Manufacturer: Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Calif.

• **Aluminum electrolytic capacitors,** said to have only a few microamperes of electrical leakage, are available in ratings from 1 to 125 uf. and 4 to 150 volts d.c. for temperature range of −20 to +85 C. Lengths are from ¾

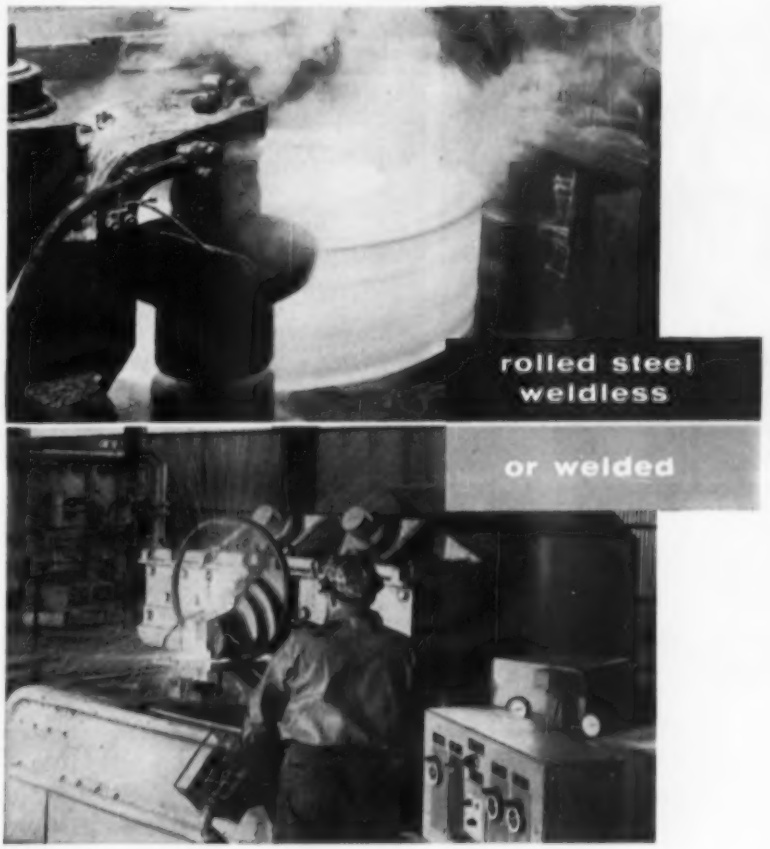


in. to 1¼ in. and diameters from ⅜ in. to ⅝ in. Unit has centered axial leads and case is insulated. Sealing is with epoxy casting resin. Manufacturer: The Magnavox Co., Fort Wayne, Ind.

• **Two precision potentiometers,** Types HA-100 and HA-105, are available in 5 and 10 turn models with standard linearity of ± 0.5%. Case lengths are ⅞ in. for 5 turn type, and 1¼ in. for 10 turn. HA-100, rated at 2 watts and

for jet engines and aircraft applications

Edgewater rings



Edgewater Rings meet the most exacting specifications of the engine and aircraft industries. The accuracy with which they are formed reduces the amount of machining or other finishing required—an important consideration especially when the more expensive materials are used.

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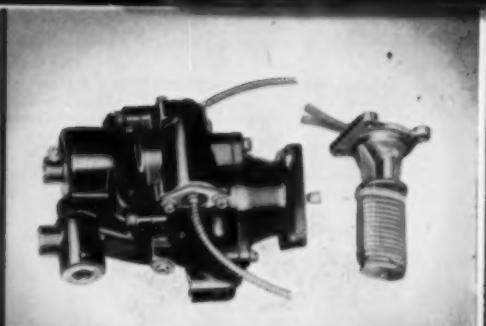
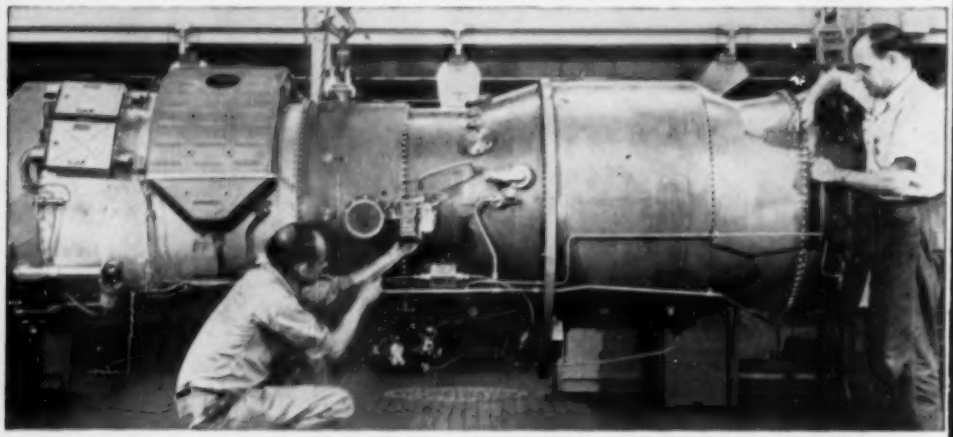
Write for brochures giving data on Edgewater Rings.

Holley engine controls selected for JT4 engines on America's first jet airliner

BLEED PISTON ACTUATOR

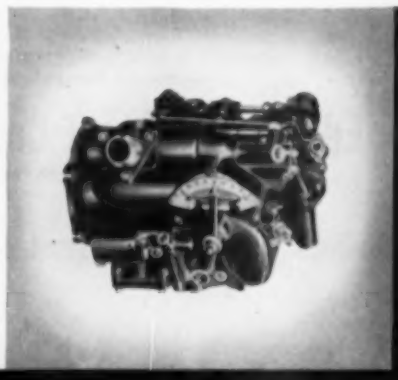


COMPRESSOR BLEED GOVERNOR



Powered by four JT4 Pratt & Whitney Aircraft engines, the Boeing 707-320 will carry 131 first class passengers from New York non-stop to the Continent in just over six hours! Each of these new engines, commercial counterparts to the J-75 which drives many of America's latest jet fighters, delivers up to 15,000 pounds of thrust. Ability to pack so much added power into a relatively small space is the result of designing engine components which will operate at higher efficiency, require less area and reduce over-all weight.

Holley Carburetor Company, working closely with Pratt & Whitney Aircraft engineers, carried out this exacting assignment on such vital engine components as: the compressor bleed governor, and the bleed governor actuator. For single and multi-engine military aircraft, the Holley main fuel control is a companion unit to the Holley governor and actuator.



For military applications, the Holley main fuel control (right) is a companion unit to the governor and actuator.

HOLLEY Carburetor Co.

11955 E. Nine Mile Road Warren, Michigan

Leader in the Design, Development and Manufacture of Aviation Fuel Metering Devices

with 3,600 deg. rotation, is available in standard resistance values from 2,500 to 75,000 ohms. HA-105, rated at 1.5 watts and with 1,800 deg. rotation, is available in values from 1,000 to 25,000 ohms.

Write International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa., for Bulletin A-5B.

• **Microsyn,** approximately 1 in. in diameter by 1 in. long, has sensitivity of 500 millivolts per deg., with threshold of 0.01 deg. at 20 volt excitation. Linearity is within 0.5% to 7 deg.

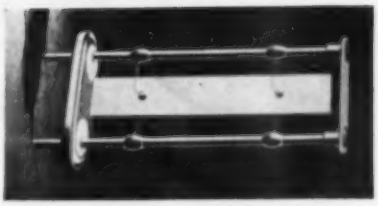
Unit weighs less than 1.2 oz., uses standard BuOrd mounting. Excitation may be 20 volt/400 cps. or 25 volt/800 cps. Manufacturer: Lear, Inc., 110 Ionia Ave., NW, Grand Rapids 2, Mich.

• **Integrating rate** gyro, Type KR-8, includes self-contained temperature control operating on the heat-of-fusion principle to maintain 80C with tolerance of ¼ deg.

Unit is 3 in. long, 2 in. in diameter,

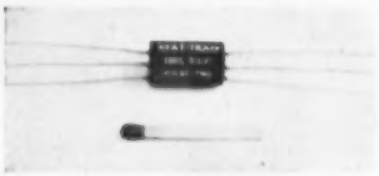
weighs 1¼ lb. Motor is 3 phase, 6.3 volts, 400 cycles, 1.75 watts. Gyro is manufactured by General Electric Company's Light Military Electronic Equipment Department, Schenectady, New York.

• **Low frequency** duplex crystal units, Type RH-8DP, are said to meet MIL C-3098B specifications for shock, vibration, aging and moisture resistance. Units provide accurate frequency control in audio range of from 4 to 15 kc., are operable over temperature range of −55 to +90C with stability of ±0.02%. They are available in standard HC-13/U metal holder, hermeti-



cally sealed, or in T6 glass bulbs. Manufacturer: Reeves-Hoffman Division, Dynamics Corp. of America, Carlisle, Pa.

• **Pulse transformers,** called STAT-TRANS, for use in transistor blocking oscillator circuits have flat-bed core with high permeability (2,400 u). Units have low leakage inductance and present a good impedance match to the transistor which permits operation at



repetition rates to 500 kc. Dimensions are ⅛ in. diameter by ¾ in. long. Manufacturer: Pulse Engineering, 2657 Spring St., Redwood City, Calif.

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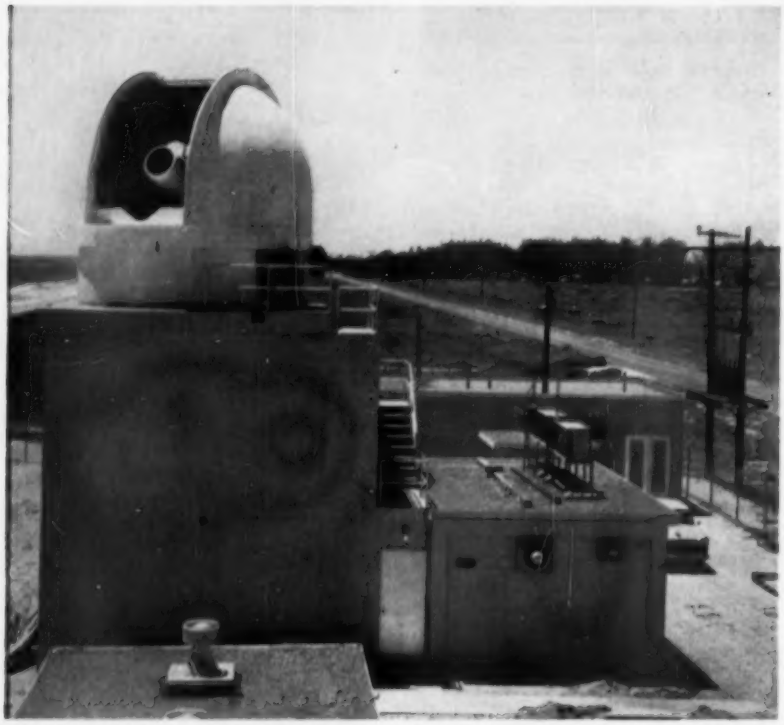
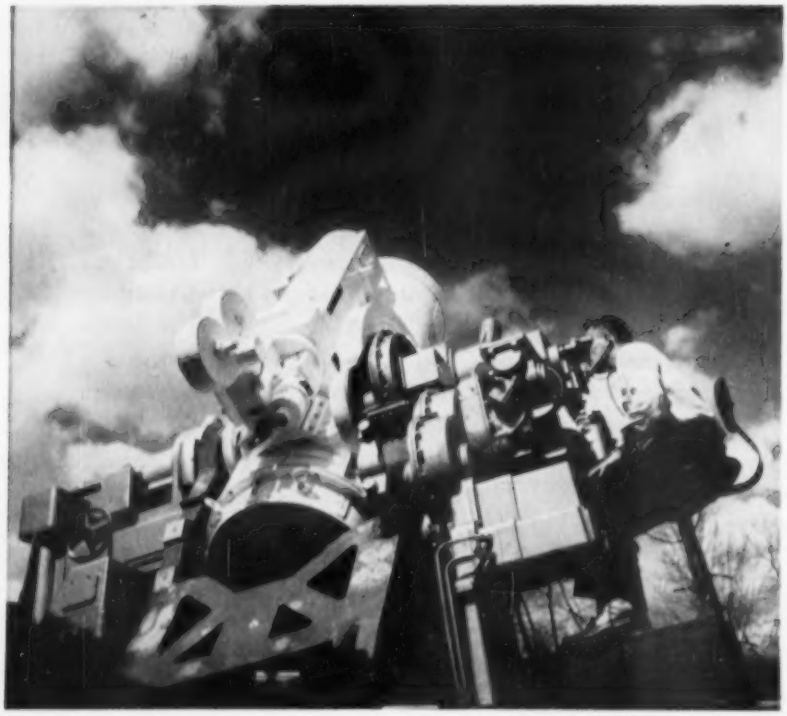
Tracking Camera Photographs Details of





ROTI II Atlast tracker in its astrodome (above) at Melbourne Beach, Patrick AFB, Fla. Tracking camera (below) is mounted at back of 100-500-in. focal length one-ton telescope.

By George L. Christian

New York—Crash program to produce a missile data collection system and telescopic tracking camera capable of following and photographing an Atlas I intercontinental ballistic missile for over 100 mi. has materialized as Recording Optical Tracking Instrument, Mark II.

Recording Optical Tracking Instrument (ROTI) was pressed into service to track recent Thor IRBM and Atlas ICBM launchings at Air Force Missile Test Center, Patrick AFB, Fla. (AW Oct. 7, p. 26.)

Instruments' powerful magnification, coupled with a high-speed 70 mm. camera, enable it to record such details of missile behavior as engine gimbaling, booster rocket performance and multi-stage disengage, even at high altitudes.

Principal instrument of the data collection station is the large optical tracking instrument, ROTI II. Cannon-like device has a 24-in. aperture and five focal lengths varying from 100 in. to 500 in. This is more than double ROTI I, developed to track V2 class missiles, which had an aperture of 12 in. and a 50 in. focal length.

ROTI II is similar to, but is more accurate and has greater magnification than, Telescopic Photographic Recorder, a mobile missile tracker recently delivered to USAF's Air Research and Development Command at Air Force Armament Center, Eglin AFB, Fla. (AW July 1, p. 75.)

ROTI and Telescopic Photographic Recorder were designed and manufactured by Perkin-Elmer Corp., Norwalk, Conn.

First of Four

Melbourne Beach ROTI is the first of four being built for Air Force Missile Test Center. Second data collection station is nearing completion at Vero Beach, Fla. Perkin-Elmer is also building similar instruments for other, undisclosed, Air Force stations.

ROTI data collection station operates as an integral part of the Patrick range communication and tracking network.

Information from radar and other communication nets are fed into the station when a missile is fired. Computers at the station convert this data into information which keeps ROTI tracking on target.

Automatic corrections are made to adjust for parallax—difference in line of sight from radar station to ROTI sta-

tion—and for the earth's curvature.

ROTI will be focused automatically and will have its exposure automatically adjusted to changing light conditions as the missile blasts across the sky.

ROTI consists of a 24-in. aperture, primary objective telescope, sighting telescopes, camera, controls and associated equipment. System, which weighs eight tons, is assembled on a Navy 5-in. gun mount.

Primary telescope has varying focal lengths ranging from 100 in.-500 in. It is two feet in diameter, eight feet long and weighs a ton. It incorporates some 200 different optical elements and a 70 mm. camera which can take moving pictures at a rate of up to 60 frames a second.

Observatory-Like Towers

ROTI is housed in towers topped by astronomical observatory-like astrodomes. Station can be operated by remote control or by range personnel with the help of "aided tracking."

When operated by range personnel, same information is fed into the tracking system as when the unit operates remotely. However, when the missile comes into sight, the operators take over the tracking visually.

With aided tracking, operators need only make the simplest mental calculations and very slight physical movements to follow the missile. Light hand pressure on a stiff-stick control, developed by Perkin-Elmer, enables the operator to adjust acceleration, velocity and position of the 2,000 lb. telescope through two electrically-controlled hydraulic drives.

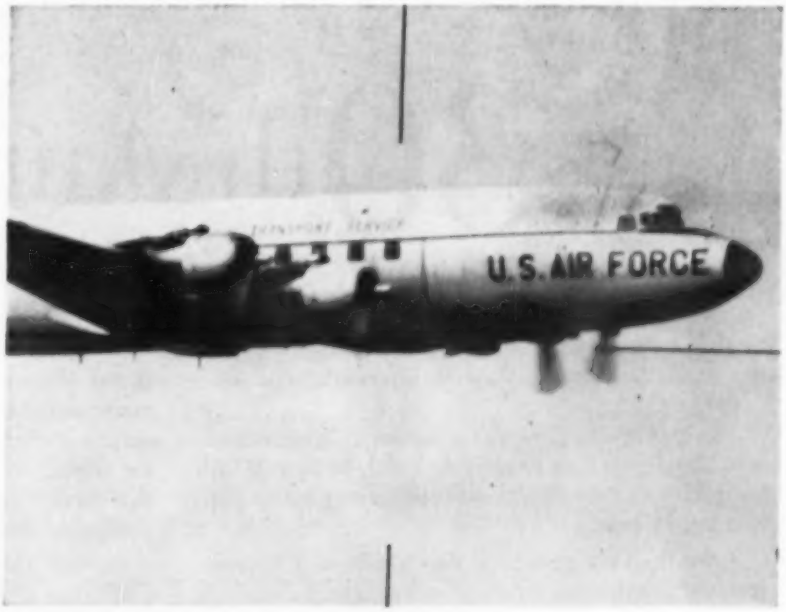
Interior of the astrodome is automatically air conditioned to remain at ambient temperature when the dome is closed and secured. Provision is also made for setting the interior dome temperature to the temperature expected at the dome's opening. Reason is that it is imperative to stabilize the temperature of the optical instrument with ambient temperature to avoid thermal shock when the dome is opened for missile tracking. Such shock could disturb the instrument's optics.

Air conditioning system also keeps the relative humidity below 50% to prevent glass surfaces from fogging and to retard corrosion.

Separate air conditioning system maintains a temperature of 70F ± 10F, and a maximum relative humidity of 55% in the tower.

Stations are completely self-sufficient

OPERATORS aim cannon-like ROTI II (above). Photograph of MATS C-118 was taken by ROTI II at 10-mi. range, illustrating camera's ability to pick up detail.



1927

1928

1931

1937

1939

1940

1949

1952

1956

30th Anniversary

On the morning of Oct. 28, 1927, a staccato roar of engines ushered in an era in commercial aviation—the Stars and Stripes flew in international skies.

The first Flying Clipper,* a Fokker F-7, lumbered into the air at Pan American Field, in Key West bound for Havana, Cuba—90 miles away across the Straits of Florida.

Since then the parade of Pan American Clippers has swiftly extended its wings to embrace the earth—wings that have changed from the 100-mile-an-hour variety, to swept back jobs that nuzzle the speed of sound. And Pan American has earned its place as pace-setter in the skies: aircraft research, engine analyzers, reduced air fares, jet stream studies, the creation of and insistence on the standards that have made the slogan—*The World's Most Experienced Airline*—an international reality.

Behind Pan Am's relentless attempt to attain perfection is the philosophy of this airline. A philos-

1934_____

1935_____

1935_____

1945_____

1947_____

1948_____

1958_____

1959_____

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A. SIKORSKY S-38
B. BOEING 314
C. DOUGLAS DC-4
D. BOEING 707
E. LOCKHEED L-749
F. FOKKER F-7
G. SIKORSKY S-42
H. DOUGLAS DC-7C
I. CONVAIR 240
J. BOEING 307
K. DOUGLAS DC-8
L. MARTIN M-130
M. DOUGLAS DC-2
N. SIKORSKY S-40
O. DOUGLAS DC-3
P. BOEING B-377
Q. DOUGLAS DC-6B

ANSWERS AT BOTTOM

Clipper Quiz

ophy that is essential to stimulating the growth of the aviation industry—make the magic of air travel available to every man.

30 years of leadership

In the past 30 years Pan American's skyway has grown from that first 90-mile flight to encompass 82 lands on 6 continents around the world. In the next 30 years, we can merely hazard guesses and dreams—but whatever progress develops, Pan American will be, as in the past, in the forefront of international aviation.

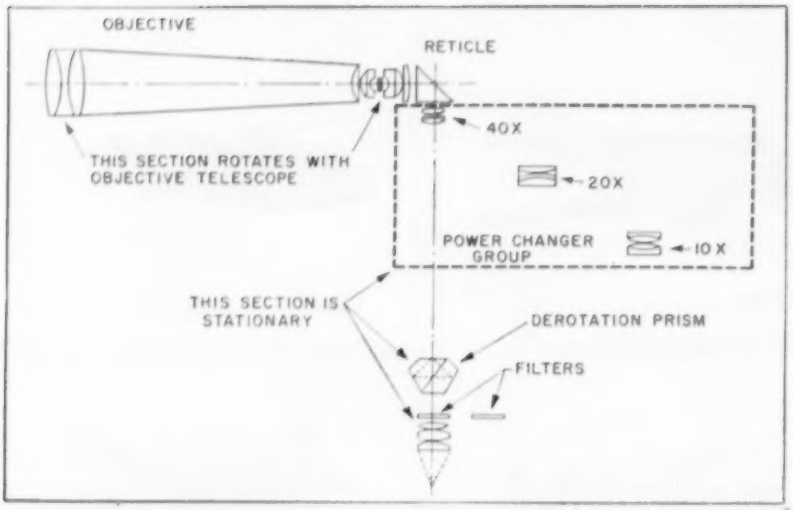
PICASSO-MADE, REG. U.S. PAT. OFF.

* * *

ANSWERS: 1927-F; 1928-A; 1931-N; 1934-G; 1935-M; 1935-L; 1937-O; 1939-B; 1940-J; 1945-C; 1947-E; 1948-I; 1949-P; 1952-Q; 1956-H; 1958-D; 1959-K.

The first responsibility of an airline is to be a useful citizen.

PAN AMERICAN



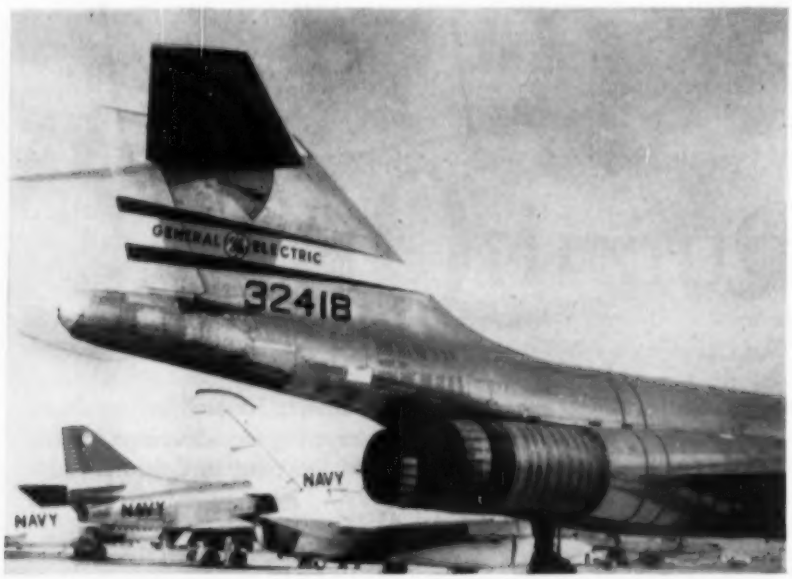
SIMPLIFIED schematic diagram shows the optical system of ROTT II. Instrument has 24-in. aperture, five focal lengths varying from 100 in. to 500 in.

units. They include their own electronic and mechanical equipment, computers, dark rooms for film developing, maintenance section and air-conditioning systems.

Dr. Roderic M. Scott, Perkin-Elmer vice president and general manager of its Engineering & Optical division, believes that ROTT will give much needed supplementary visual aid to telemetered data and radar information concerning a missile's successful or unsuccessful flight.

Dr. Scott added, "ROTT's photographic tracking system becomes a valuable commodity, especially when stacked against the many scientific manhours that could be spent probing for a missile's fault."

Besides designing and building ROTT, Perkin-Elmer Corp. is also responsible for construction of the data collection stations, and for training personnel to operate them. Radio Corporation of America Service Corp., which has technical supervision of the missile range, will operate the stations for the Air Force.



Voodoo Used as Engine Test Bed

Test installation of General Electric J79 turbojet engines in a McDonnell JF-101A Voodoo fighter reveals long tailpipes and scalloped nozzles. Fuselage has been modified directly above tailpipes. Engine test bed is based at Edwards AFB, Calif.

▲

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Air Flow	60 CFM
Fan Air Inlet Pressure	18 PSIA
Fan Pressure Rise	1.2 inches water
Heat Exchanger Pressure Drop	1.0 inches water
Liquid	Water Methanol (70% Methanol)
Liquid Flow	0.4 GPM
Heat Rejection*	300 Watts
Fan Power	30 Watts, 110 V., single phase, 400 cycle
Package envelope dimensions	7 x 6 x 3 inches
Package wet weight	2.5 lbs.

*Assumes Class A (85°C.) electronic components, liquid inlet temperature to heat exchanger, 55°C. Includes heat from fan motor.

This high performance AiResearch package cools sealed and pressurized electronic equipment. The fan circulates air through the liquid cooled heat exchanger and over electronic components in a hermetically sealed module. Air cooled units are also available. Fan and heat exchanger are designed, built and packaged by AiResearch for matched performance. Package size is tailored to your individual cooling requirements.

The Garrett Corporation, through its AiResearch Manufacturing divisions, is an industry leader in components and cooling systems for aircraft, missiles and nuclear applications. This wide experience is now being offered to the electronics industry to provide a cooling package to meet any cooling requirement. Send us details of your problem or contact the nearest Airsupply or Aero Engineering office for further information.

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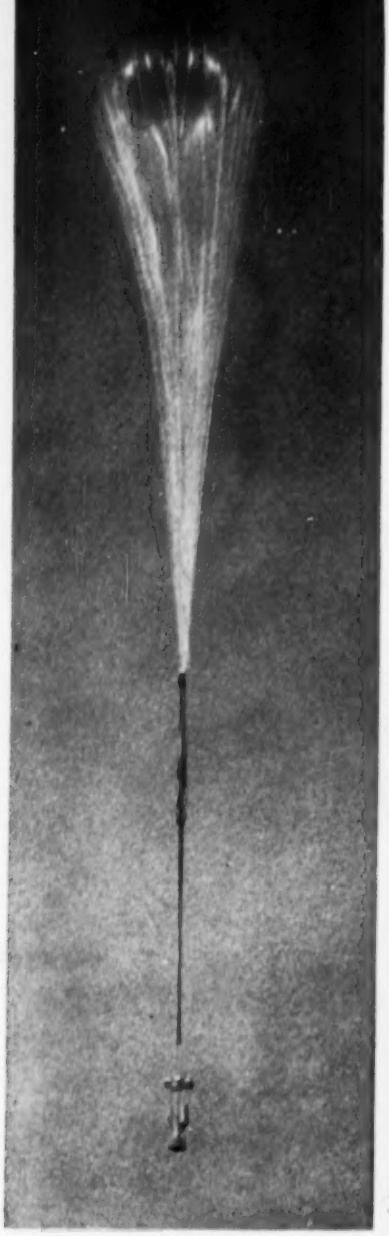
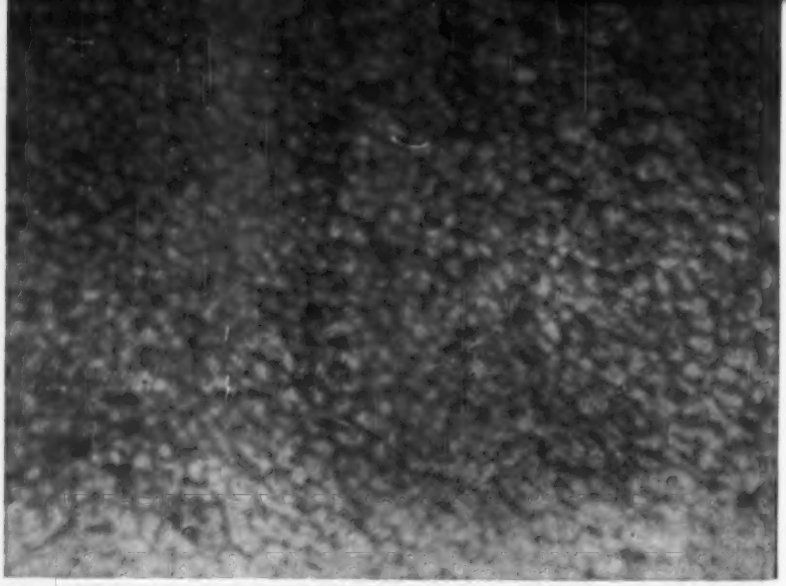
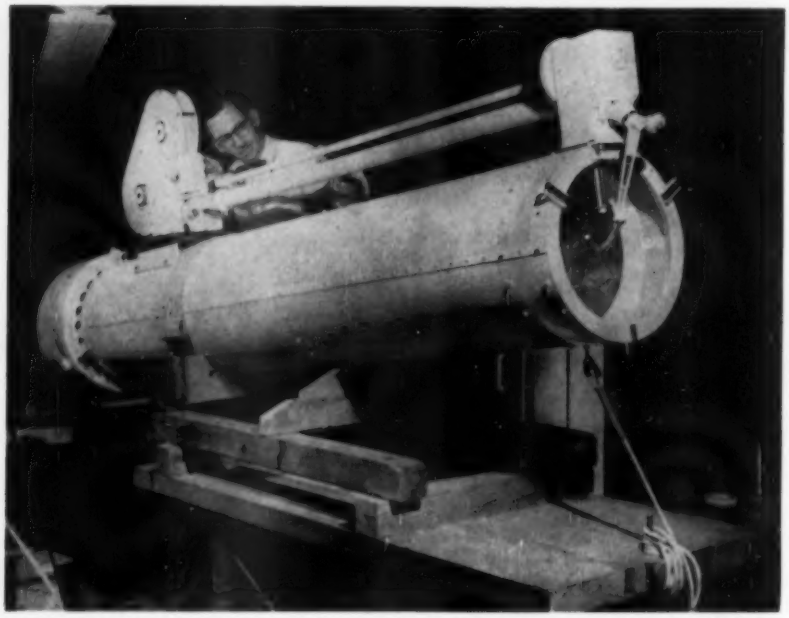


PAPER-THIN plastic Skyhook balloon lifting Stratoscope telescope and camera to altitude of 80,000 ft.



STRATOSCOPE photo of sun's surface taken from 80,000 ft. where camera was above 90% of the earth's atmosphere. Spots are turbulent areas 300-500 mi. apart.



UNIQUE 300 lb. solar telescope and camera (mounted rear) prior to high altitude flight.

Balloon Camera Gets 'Closeup' of Sun

New York—Sharpest pictures ever taken of the sun were obtained with a camera and telescope suspended from a paper-thin plastic Skyhook balloon (AW Oct. 10, 1955, p. 45) 80,000 ft. high, where they were above 90% of the earth's photo-distorting atmosphere.

Flight was first of a series, called Project Stratoscope, being conducted for the Office of Naval Research.

Second flight was made on Oct. 17 over South Dakota.

Dr. Martin Swartzschild, Eugene Higgins Professor of Astronomy, Princeton University, for whom the camera was built, hopes that the camera will produce photographs—expected to be three times clearer than possible with the most powerful earthborne telescopes—of the always-present turbulence on the sun's surface. Earth telescopes are hindered by the earth's atmosphere. Because of this interference, only those turbulent eddies on the sun's surface which are 600 mi. or more in diameter have been readily distinguishable in the past.

Stratoscope pictures are expected to reveal the true size of these giant eddies as well as smaller local hot-gas storms, solar flares and, ultimately perhaps, long range radio disturbances emanating from the sun.

Result will be collection of more fundamental data about the sun which will allow a better understanding of the true activity on the sun's surface and its effects on the earth's atmosphere.

Specially-designed Stratoscope telescope is 9¼ ft. long and weighs about 300 lb. Its primary element is a 12-in.-aperture f.8 quartz mirror. The designer,

Painting by Chesley Bonestell from the book *The Exploration of Mars* by Willy Ley, Wernher Von Braun and Chesley Bonestell, published by Viking Press ($4.95) ©CB

Fenwal will help bring 'em back alive

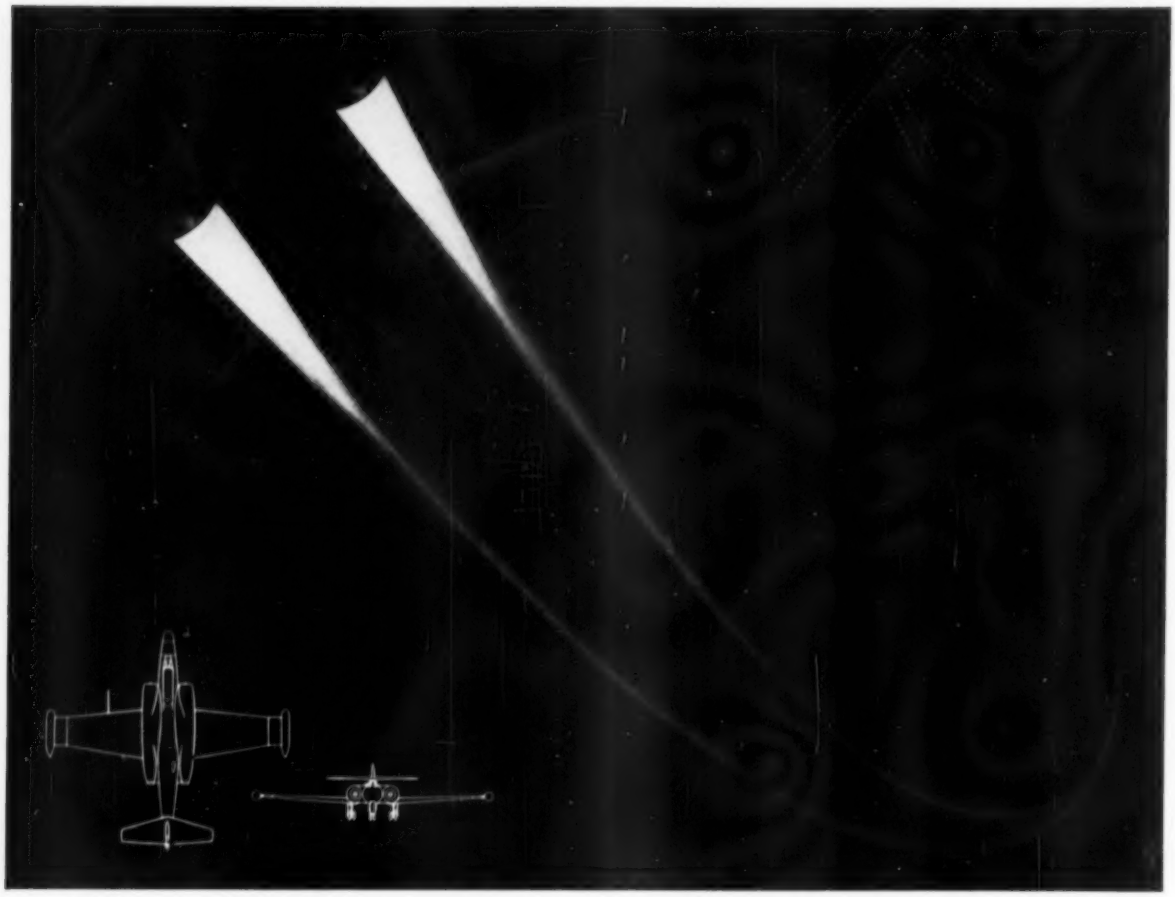
Space men exploring Mars not only take along their own atmosphere — but bring it back. When you say "climate" you have to include "temperature" . . . and when you say "temperature control" you can't be comprehensive without saying "Fenwal."

Since the Mars explorers will be gone some three years, reliability in temperature control is crucial, to say the least.

Fenwal advanced engineering not only includes the imaginative, but the practical, too. Fenwal's current work on thermistor sensing devices will be a good experience platform for space platforms. These devices already include, in their many forms, "skin temperature sensing" in aircraft and missiles and protecting windshields from overheating.

To enlist Fenwal's ability to help meet *your* present and future control problems, write Fenwal Incorporated, Aviation Products Division, Ashland, Massachusetts.

Fenwal *Controls Temperature . . . Precisely*



CF-100 all-weather night interceptor . . . a mainstay of North America's air defense and of NATO's in Western Europe. Built by Avro Aircraft Limited, Toronto, Ontario, Canada. Operated by the Royal Canadian Air Force.

Twin blasts for a fast climb

What gives the Canadian Orenda jets their high power to lift heavy radar and fire control equipment to bomber lane invasion heights?

Combustion temperatures above 1500°F. And that's where Inco's High Temperature Alloys come in: specifically, two alloys.

Combustion chambers and transition sections are made of Inconel* nickel-chromium alloy. Turbine blading is Inconel "X"* Type 550 alloy. (Basically an age-hardenable nickel-chromium alloy with excellent creep strength in the 1500°F range.)

Both these nickel containing alloys have outstanding resistance to corrosion and oxidation at temperatures up to 2000°F. Both alloys are workable. Both are practical in cost.

Have you a metal problem?
High Heat? Sub-zero cold? Corrosion?

Contact Inco Mechanical Engineering Section. Chances are the information you want is in our files.

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Where Inco Nickel Alloys are used in jet aircraft

Inconel
Combustion liners
Transition sections
Insulating blankets
Lock wire and rivets
Fuel line tubing

Incoloy "T"
Transition sections
combustion liners

Inconel "X"
Rotor discs
Afterburner bellows
High-temperature bolts
Rocket engine rotors
Blading (Type 550)

"S" Monel
Ball bearing retainer rings

Nimonic Alloys
Combustion liners
Transition sections
Vaporizer tubes
Turbine blades
Rotor discs

Inconel "W"
Tail Cones
Afterburners

Monel
Lock wire
Fine fuel line tubing
Rivets

Incoloy "901"
Turbine discs

Inconel "700"
Turbine blades

Pure Nickel for electrical and electronic gear. Primary Nickel as alloying element in other materials. Inco Precision Castings in many different alloys.

Inco Nickel Alloys are marketed under the following trademarks:
MONEL • "R" MONEL • "K" MONEL "KR" MONEL • "S" MONEL • INCONEL INCONEL "X" • INCONEL "W" • INCONEL "700" • INCOLOY • INCOLOY "T" INCOLOY "901" • NIMONIC Alloys

INCO NICKEL ALLOYS

Perkin-Elmer, say that "a unique feature of the instrument is the Newtonian secondary quartz mirror which is mounted on a swinging arm so that it will remain in the sun's image only long enough to obtain a photographic exposure."

Mirror, which rotates once a second, actually will be cooling about 98% of the time. This arrangement is necessary to prevent the mirror from being distorted or having its aluminized coating burned off by the solar energy concentrated on it by the telescope's primary mirror.

Possible effects of solar heating on the primary optic's focal length required special construction. Optical system was designed so that the primary image is transferred from the secondary mirror to the film plane by a relay lens having a 25X magnification. Net effective focal length of the system is 200 ft.

Lens Movement

However, since solar heating may change the focal length of the primary optics, the relay lens is designed to move continuously, searching over a region of space for the correct focus. During a 20-sec. cycle, the relay lens will be in 20 different positions. Camera will record all 20 shots, but at most only one will be in perfect focus, with perhaps two near the best focus. Hence,

Galley Sheet Metal

RIGID-tex Metal has been chosen for use in the galleys of Eastern Air Lines' DC-7B, Electra and DC-8 airliners. Metal features include: high strength-to-weight ratio, glare-free surface, mar-resistance and easy cleaning with a damp cloth. EAL's galleys use type-302 stainless steel. RIGID-tex also comes in many other metals, sheet or strip, solid or perforated. There are over 40 patterns from which to choose. Address: Rigidized Metals Corp., 736 Ohio St., Buffalo 3, N. Y.

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— and it's chock-full of ideas to speed aircraft maintenance operations.

Like dry washing and wet washing of plane exteriors ... engine parts cleaning ... maintenance of exhaust stacks, augmentor tubes and combustion heaters. You'll find valuable tips on cleaning engine test cells, stripping paint, steam detergent cleaning, cleaning ramps, aprons and hangar floors.

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although the camera will shoot 8,000 35mm. photographs during a trip, not more than 400 will be usable.

In addition to the telescope-camera and its balloon-lifting equipment, the project uses an automatic pointing control to keep the camera constantly aimed at the sun. A parachute is included to return all the equipment safely to earth.

Low Coefficient of Expansion

Tube of the Stratoscope is made of Invar metal because of its very low coefficient of expansion which will minimize changes under the wide temperature extremes to which the instrument is subjected.

Further aids to cooling are 40,000 perforations through the tube which permit air to circulate freely and avoid a chimney effect which might hurt image quality.

Prime contractor for the instrumentation portion of the Project Stratoscope is Princeton University Observatory, which is directed by Dr. Lyman Spitzer, Jr.

Subcontractors for instrumentation are Perkin-Elmer Corp., which designed and built the telescope system, and the Upper Air Laboratory (Department of Physics) and the Research Services Laboratories of the University of Colorado, which developed the automatic pointing control mechanism.

Air Force Funds

The Air Force Cambridge Research Center, Bedford, Mass., provided financial assistance for the solar instrumentation portion of Stratoscope. Dr. John W. Evans, Superintendent of the Sacramento Peak Observatory, Sunspot, N. M., supervised this Air Force assistance.

Prime contractor for the balloon, suspension system, launching and recovery of the balloon and all equipment is the Balloon Department, General Mills, Inc., Minneapolis, Minn.

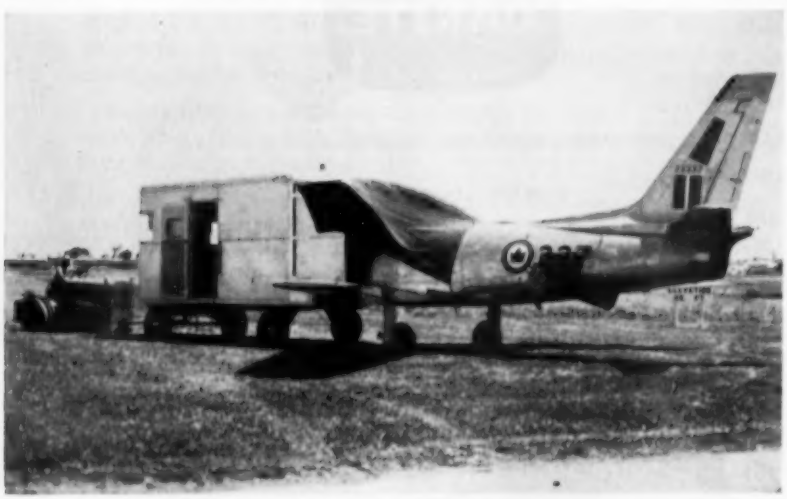
Dr. Sidney G. Reed, Jr., Physics Branch, and LCDR Edmond A. Basquin, USN, Air Branch, are the stratoscope project officers for the Office of Naval Research.

Project Stratoscope is a continuing phase of the program of upper atmosphere research begun by the Office of Naval Research in 1946. Other continuing projects include Skyhook (unmanned) plastic balloon flights and the Stratolab (manned) high-altitude space laboratory.

Rocket Firm Building Two Static Test Bays

New facilities are being completed by Grand Central Rocket Co., Redlands, Calif.

Firm is building two new static test bays on its 8,000-acre Beaumont proving grounds, each capable of handling solid propellant rockets of 1,000,000 lb. thrust. Other construction includes a 20,000 sq. ft. tooling and rocket assembly building, an administration building wing and a propellant-mixing building to accommodate a remote control chemical mixer that will increase the company's solid propellant production to 1,500,000 lb. per month.



Trailer Services Sabre Fire Control

Canadair Ltd. designed fire control system servicing vehicle to aid inspection, servicing and maintenance of Sabre aircraft in the field. Trailer floor forms walkway around entire nose section of plane; vehicle is equipped with work bench, storage shelves, drawers and two 28-v. outlets. Unit was built for the South African Air Force; three more are being constructed for the German Air Force.

Manufacturing at Marquardt

by
Roy E. Marquardt
President

Another barrier – the PRODUCIBILITY BARRIER – is currently being penetrated by Marquardt engineers. What do we mean by PRODUCIBILITY BARRIER?

Advanced designs for supersonic ramjet powerplants coming from the drawing boards call for strength to weight ratios and high-precision tolerances previously unobtainable. New high-temperature alloys are meeting the metallurgical demands, but do not readily lend themselves to conventional machining and fabricating techniques.

Those members of the Marquardt team charged with pioneering new production methods comprise our Van Nuys Manufacturing Division. Here – under the direction of John S. Liefeld – creativeness and imagination join forces with a thorough understanding of standard shop practices to produce acceptable hardware. But management realizes that to do his best work the engineer must be supplied with the most up-to-date tools of his trade.

Exemplifying our continuing efforts to this end: a specially designed, half-million dollar roll-former is being added to the company's ever-expanding production facilities. This machine will be capable of spinning conical, tubular, venturi, and parabolic configurations of a size heretofore considered impossible or impractical to fabricate as a single piece. A completely safe, close-up view of the actual metal forming will be afforded the operator by means of two closed-circuit TV cameras mounted on the machine frame.

We are also acquiring other automatic machines – numerically controlled units capable of multiplying the output of their manually operated counterparts several times. Utilizing punched and magnetic tape, these machines are expected to greatly expand the scope of Manufacturing Engineering.

Another of the modern production techniques at Marquardt puts to use modern optics equipment for the construction of prototype engines.

At Marquardt, the engineer will find a broad range of challenging assignments and the opportunity to further his career through supplemental educational programs.

Within this Division, engineering openings exist now for:

METHODS ENGINEERS · PROCESS ENGINEERS · TOOL ENGINEERS · AUTOMATION ENGINEERS · NUMERICAL CONTROL ENGINEERS

For information about these positions and the professional engineering environment at Marquardt, we invite you to write Jim Dale, Professional Personnel, today.

Roy E Marquardt

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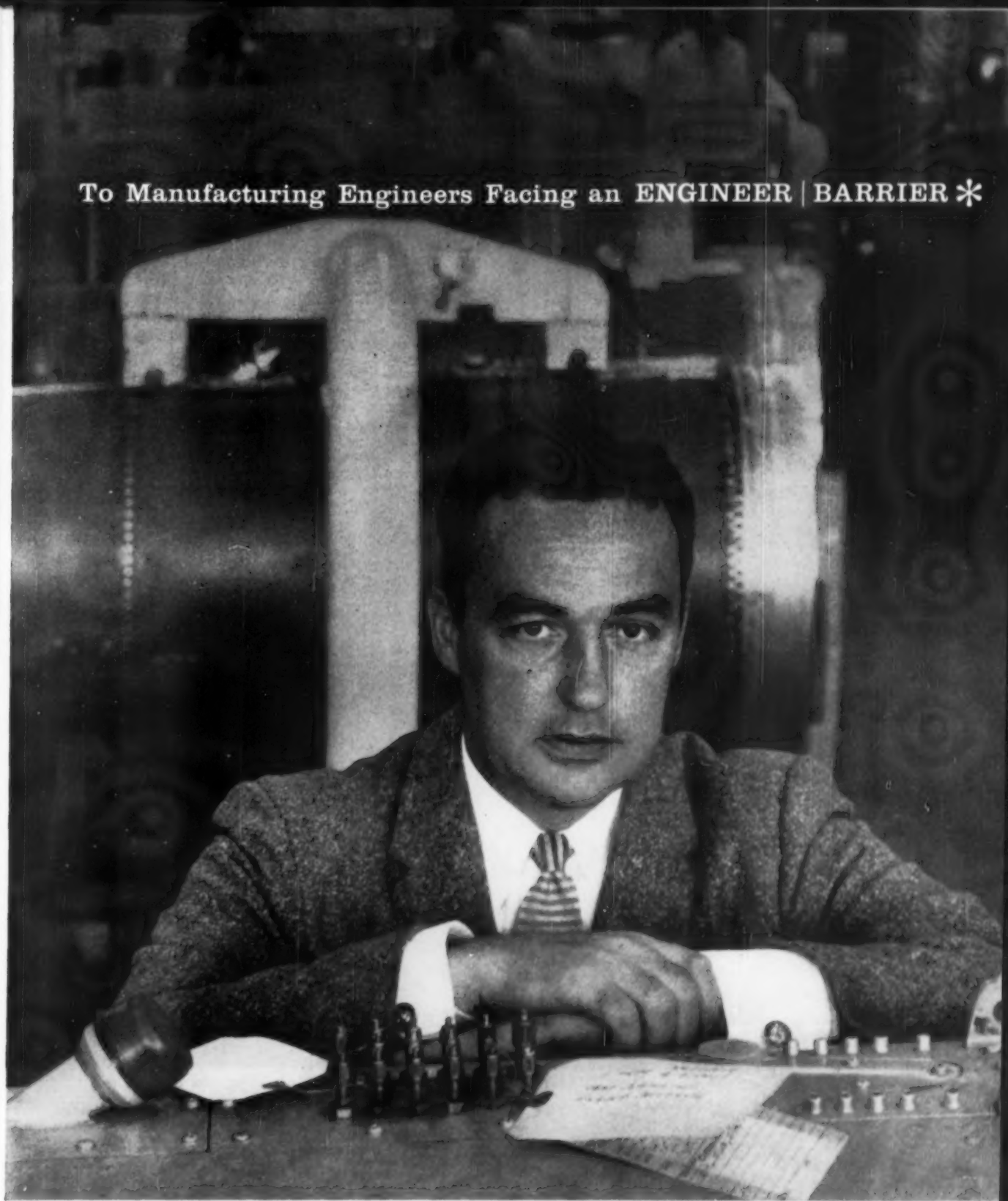
To Manufacturing Engineers Facing an ENGINEER | BARRIER *



Shown here: John S. Liefeld, Director Van Nuys Manufacturing Division

Marquardt Means Opportunity– Manufacturing engineers no longer need feel stymied because of the lack of up-to-date equipment. At Marquardt Aircraft – the company where an ENGINEER/BARRIER* has never existed – you will find the most advanced tools of your trade. Look to your future by looking to Marquardt, today. Address your inquiries to Jim Dale, Professional Personnel, 16551 Saticoy Street, Van Nuys, California.

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* ENGINEER | BARRIER—an achievement level beyond which you cannot advance

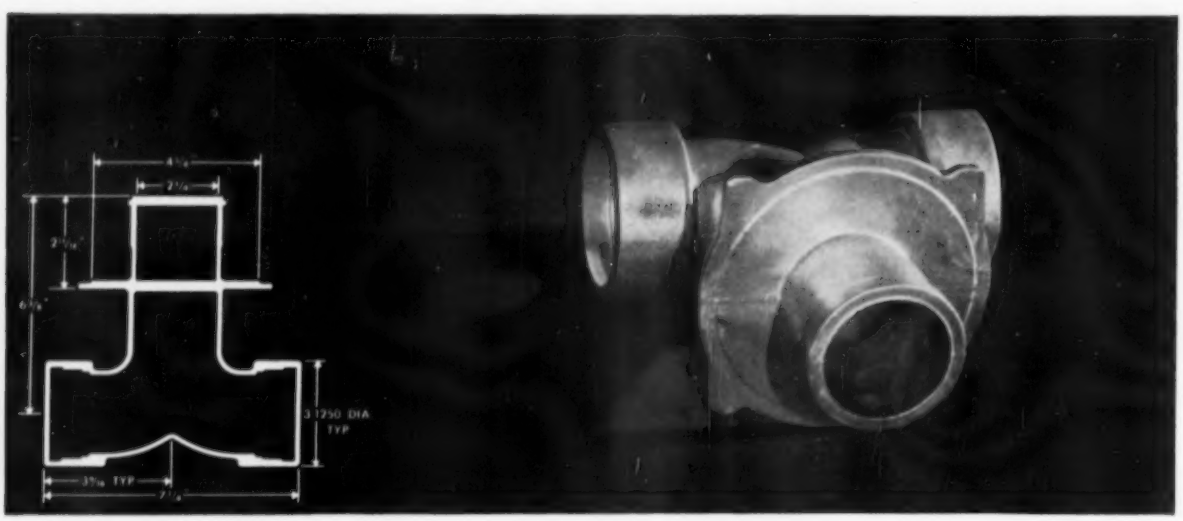
Now Alcoa offers strong, thin-wall precision castings

70 pounds saved in new interceptor fuel system

Aviation engineers have found that exterior aerodynamic requirements and internal space limitations transform today's jet aircraft fuel system into a plumber's nightmare. Necessarily large orifices and tortuous passages through and around other systems components have introduced the addition of scores of elbows and connecting fittings to supply a constant flood of fuel to the power plant. Until now, each additional fitting carried an unavoidable weight penalty.

Now, thanks to new Alcoa precision casting techniques, the finished fuel system fittings used by one major aircraft company weigh 30% less than they formerly did as sand castings. They perform better, too. Plaster cast, in alloy 356-T6, with a wall thickness of .080 in. and a tolerance of plus or minus .015 in., these parts establish a new standard in aircraft fuel line castings. Not only are they half the thickness previously considered minimum, but the tolerance itself has been halved. Although specifications still call for impregnation of these parts for fuel system service, they have thus far passed porosity tests without it. In fact, these plaster castings compare favorably with the soundness and strength of permanent-mold castings.

Savings up to 20% in time and money were realized by this company when it was discovered that the precision and concentricity inherent in the fittings made it unnecessary to prepare expensive adjustable jig and fixture setups for finish machining operations. For the complete story on how this new development in casting techniques can benefit you, call your Alcoa sales engineer. He'll be glad to work with you in developing sound, lightweight castings that can save you time and money. Aluminum Company of America, 1800-W Alcoa Building, Pittsburgh 19, Pa.



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Camera Ready to Track Soviet Satellite

By Russell Hawkes

South Pasadena, Calif.—First of 12 tracking cameras intended as part of the satellite tracking network in IGY Project Vanguard has been hurried into service in the backyard of its assembly plant here to track the first Russian satellite.

The specially designed, three-ton camera is operating in a simple observatory originally intended only for testing of completed cameras before they were shipped to their assigned stations.

First camera was to have been sent to a prototype satellite tracking station at White Sands, N. M., for intensive shakedown trials. Its final assembly was completed several days before the firing of the Russian satellite but there was no time to ship it to a regular tracking station. An attempt was made last week to track the orbiting last rocket stage after it was rumored that the rocket was sufficiently brighter than the satellite itself to be tracked in daylight. Attempt failed because of cloud cover.

First good tracking conditions are expected early this week.

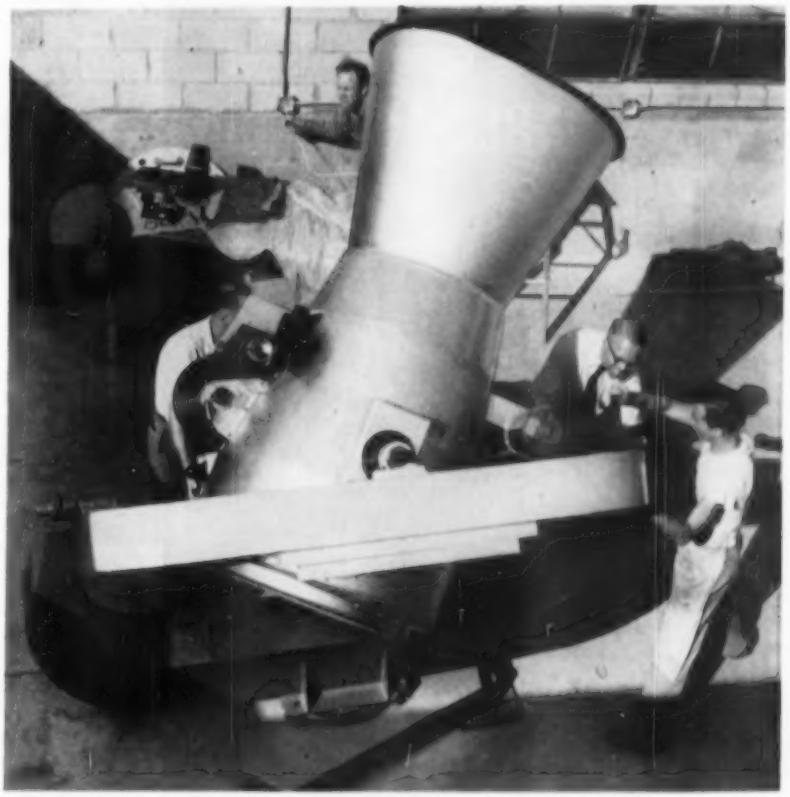
Satellite Tracked at Dusk

Satellite can be tracked only in twilight because after nightfall it is eclipsed by the earth and during the day it is obscured by skylight. Precession of its orbit, due to oblateness of the earth and concentration of mass near the equator, will bring the satellite across the western part of the U. S. every day for a period of four or five days, while it is in the twilight zone, after which it will not be observable for perhaps 40 days. When Vanguard is fired it is expected to be observable for about 15 days out of 30. Dr. Karl G. Henize of the Smithsonian Astrophysical Observatory, who is in charge of optical tracking of the satellites, doubts that the Russians planned to make it difficult for the satellite to be tracked from this country. He points out that the orbit had to be planned for frequent early observations from Russia for them to evaluate the launching.

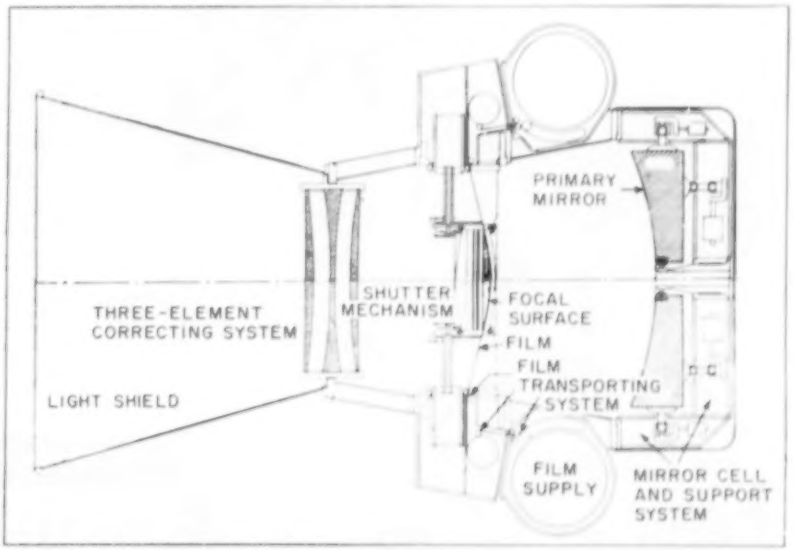
Satellite Tracking Methods

There are three chief means of satellite tracking: radio, visual and photographic. The Smithsonian Astrophysical Observatory was assigned responsibility for the latter two—Operation Moonwatch and the 12-station photo tracking net. Radio tracking will be handled by the Naval Research Laboratory's Minitrack network.

Optical system for the Schmidt-type



THREE TON tracking camera is operating in a simple observatory originally intended only for testing of completed cameras before they were shipped to their assigned stations. First camera was to have been sent to White Sands, N. M., for shakedown trials, but instead was set up to track satellite rocket.



OPTICAL system consists of a 31-in. dia. spherical mirror and a 20-in. dia. correcting plate with three lens elements using a different type of glass in the center element. Chromatic aberration is reduced to zero at three distinct wave lengths. Camera speed is F/1. Film speed is 0.003 meter-candle-seconds.

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Such power is the business of Propulsion Research Corporation, a subsidiary of Curtiss-Wright Corporation. PRC accessories are setting new standards of performance, precision, efficiency and dependability in both aircraft and missile applications. Design, development and manufacturing activities are consolidated in a smoothly integrated department, able to produce efficiently and economically to the most stringent requirements of both commercial and military specifications.

Illustrated are three typical products manufactured by Propulsion Research — products that are contributing importantly to some of the most advanced aircraft in the skies today.

PROPULSION RESEARCH CORPORATION
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camera was designed by Dr. James Baker of Harvard University and made by the Perkin-Elmer Corp., Norwalk, Conn.

The camera structure and its mechanical design were conceived by Joseph Nunn and built by Boller and Chivens Inc. here. Dr. Henize said he believes it is the only camera in the world designed specifically for precise tracking of satellites. He said the Russians would not require such a camera since the United States has announced its intention to build a photo tracking system and release the data it gathers to anyone who is interested.

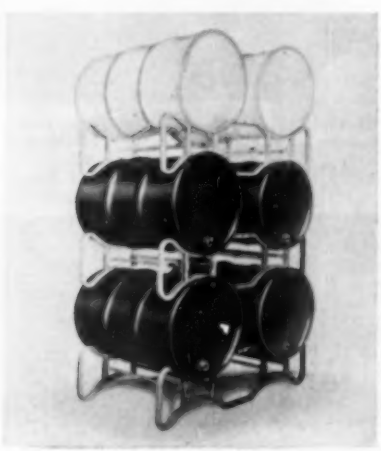
Problem in camera design was how to record faint light from satellite moving at an angular velocity of as much as 1.5 deg. per sec. Photo-visual magnitude of the satellite is about 6. This is about $\frac{1}{8}$ the brightness of the faintest star perceptible to the naked eye.

Same Angular Velocity

Automatic tracking mechanism is designed to swing the camera at the same angular velocity as the satellite, making longer exposures possible without blurring and dimming of image. Satellite is located precisely by its relation to background stars in the picture whose movements are well known. Background stars and satellite cannot be shown as points in the same exposure because different angular veloci-

707 Assembly Progresses

Forward fuselage section for the third Boeing 707 jet Stratoliner is shown in construction jig at Boeing Transport Division, Renton, Wash. Number one airplane is nearing completion in final assembly area. Pan American World Airways will be the first airline to receive the jet transports; delivery is scheduled for late 1958.



Barrel Rack

These barrel racks are designed to allow standard lift trucks to handle and stack loaded or empty barrels and drums. Eliminating the need for special drum-handling equipment, the racks are so made that fork lifts can pick up two drums from front, back or either side. Units also make it easy to get at bunged drums for draw-off. Channel-steel racks will support 7,500 lb. in 18-gage drums and 14,000 lb. in 16-gage drums. Manufacturer: Pressed Steel Division, Republic Steel Corp., 6100 Truscon Ave., Cleveland, Ohio.

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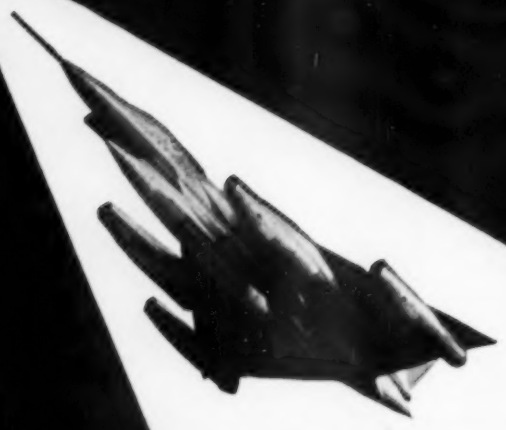

USAF B-58 "Hustler", America's first supersonic bomber, Convair Division, General Dynamics Corp., Fort Worth, Tex.

Westinghouse apparatus for B-58: (1) Sundstrand Constant-Speed Drive and Westinghouse 40-KVA Brushless Oil-cooled Generator, (2) Regulator-Control Panel, (3) Transfer-Contactor, (4) Current Transformer Assembly.

First airborne generator, shown on Billy Mitchell's Spad 16. Photo: Courtesy of The Smithsonian Institution, Washington, D.C.

Westinghouse is still the leader in airborne electrical power!

From the single-blade, wind-driven Westinghouse generator above, shown on Billy Mitchell's Spad 16, to the amazing electrical components of Convair's supersonic B-58 "Hustler", is an epoch in air power.

And it's an epoch Westinghouse helped pioneer with *1,060,744 KVA of service* to the aviation industry.

For Westinghouse and the aviation industry have been partners in progress since 1917. The first airborne a-c generator, the multi-generator parallel a-c system and today's fully protected automatic system are just a few of the milestones.

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J-03038

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ties cause one or the other to appear as a trail. Solution embodied in Baker-Nunn camera is to oscillate the tracking mechanism speed between satellite velocity and the component of sidereal motion of background stars parallel to satellite orbit. A double exposure showing first the satellite and then the background stars as points allows precise determination of position. Movement of the satellite between exposures can be calculated from the distance between point and trail and the known time between exposures.

Optical system consists of a 31-in. dia. spherical mirror and a 20-in. dia. correcting plate with three lens elements using a different type of glass in the center element. Chromatic aberration is reduced to zero at three distinct wave lengths. Camera speed is f/1.

Film speed is 0.003 meter-candle-seconds. Film frames measures 2 in. x 12 in.

Oblong field of the camera measures 31 deg. on its long axis by 5 deg. on its short axis.

Camera Is Gimbaled

There is no provision for locking the camera on its target or for reading out camera angles from shaft positions. The camera is gimbaled and rotates on three axes, but is clamped on two. All active tracking is carried out on the third.

It is set up to track automatically along a predicted orbit. Obviously, this predicted orbit must be close to the real one or no picture will be recorded.

To this extent the value of the camera is dependent on radio tracking or some other means of getting an approximation of the satellite's orbit. Once given an acceptable approximation, the camera can locate the satellite within 2 sec. of arc and 0.001 sec. of time.

Need Three Shots

To get a precise fix on the satellite requires three good shots from two positions.

This should pose no problem since Henize is reasonably sure of getting at least three good shots from a camera in one passage of the satellite.

Variations in the height of the orbit will indicate something of atmospheric density at that level. Altitude is now estimated at 360 mi. Variations in the angle of the orbital plane will indicate the shape of the earth and the distribution of its mass. When the position of the orbit is accurately known it will be possible to calculate distance between stations on different continents to an accuracy within 30 ft.

This is about 1/5 the error in past calculations.

ENGINEER OPPORTUNITIES AT RAYTHEON

DOPPLER NAVIGATION EQUIPMENT is readied for flight testing under operational conditions. Engineers at the Maynard Laboratory hold responsibility for program from initial study phase through prototype production.

Newly formed project groups solve complex airborne radar problems

Engineers like the project-type organization at Raytheon's Maynard Laboratory. It gives them maximum diversification in their work on the most advanced radar navigational and control problems of the day.

At Maynard, you'll find projects involving many areas of aircraft navigation and guidance systems . . . doppler navigation, velocity check systems, night-fighter operations systems, flight-control systems, altimeters. There is also interesting new work on countermeasures equipment.

Career opportunities for men at all levels now exist in the following areas:

- ADVANCED CIRCUIT DESIGN
- ELECTRONIC PACKAGING
- ANTENNA DESIGN
- MICROWAVE COMPONENT DESIGN
- HEAT TRANSFER ENGINEERING
- SPECIFICATIONS WRITING
- TECHNICAL WRITING
- SYSTEMS ANALYSIS & ENGINEERING

For complete details on engineering positions in any of Maynard's project groups, please write John J. Oliver, P.O. Box 87A, Raytheon Maynard Laboratory, Maynard, Mass.

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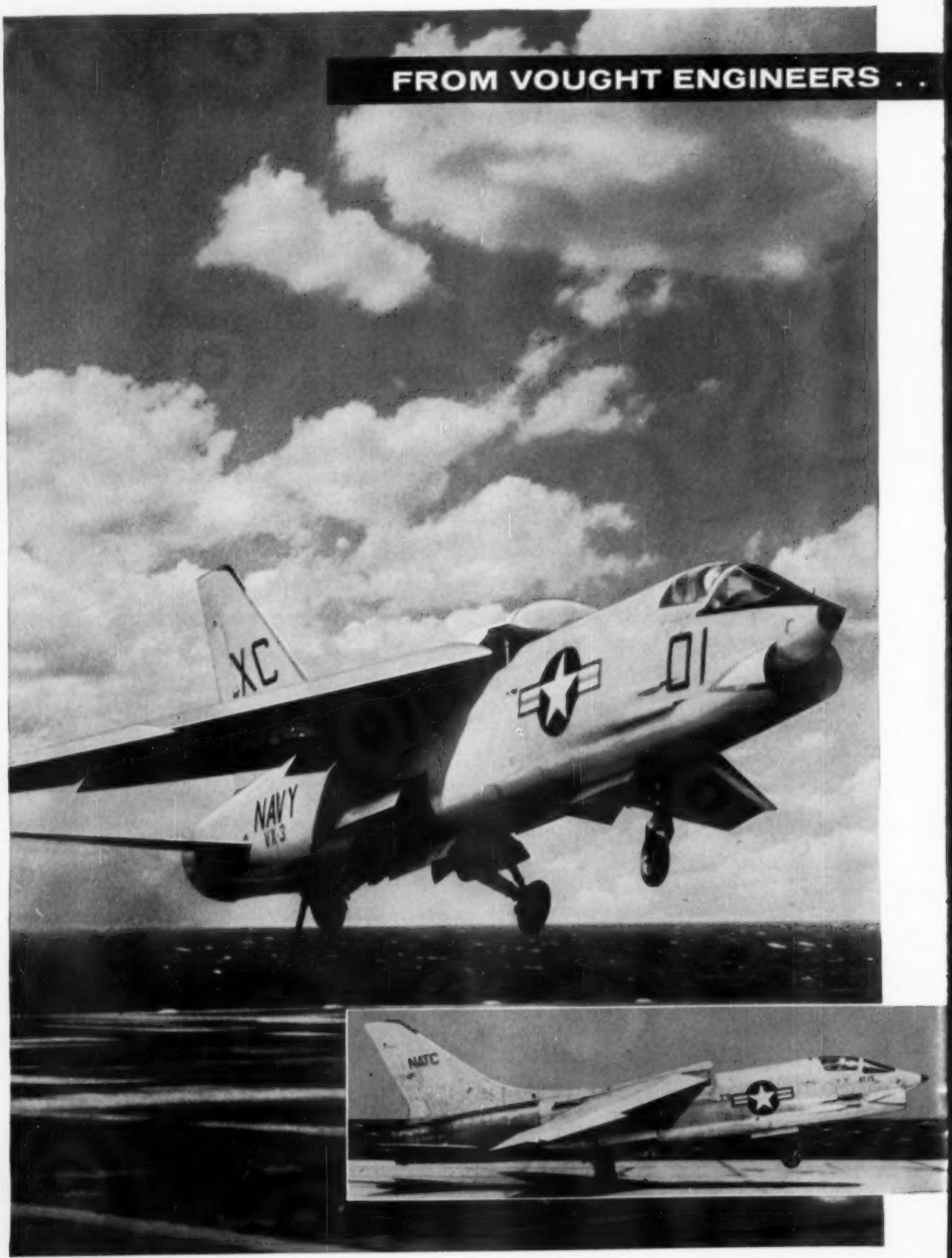
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. . NEW SPEED, NEW SAFETY IN A HINGED WING

Profile of a New Approach to a Carrier Landing

As he whistles in for a carrier landing, the Crusader pilot has the full forward visibility he so vitally needs.

Up above the cirrus, he has the slashing, 1,000-mph-plus speed that assures air superiority.

By all that governs carrier fighter design, he should be entitled only to *one or the other* of these two features. But Vought engineers conceived a variable incidence wing which enables the Crusader to give him both.

They developed a continuous wing, attached to the Crusader fuselage by pivot lugs at the trailing edge and by a hydraulic strut near the leading edge. Prior to landing, the wing may be tilted into desired approach attitude. The fuselage, meantime, remains almost horizon-level—and the pilot has a straight-on view of landing signals and the oncoming deck.

By achieving full approach visibility without elevating the pilot seat, Vought engineers have kept the Crusader canopy small, simple, sleek. This minimizes fuselage drag, and is a major factor in the Crusader's Thompson Trophy-winning speed.

Typically, the Crusader's developers approached their assignment with firsthand operations analysis, completed it with technical free-thinking. Again, they came up with an original weapon . . . and an important new concept as well.

Weapon System Development at Vought

Successful weapon systems and well-rounded engineers have a common denominator at Vought. It's the "project-group" system, a highly effective brand of development teamwork that makes each engineer an inside man in the over-all development picture.

On the *Crusader* fighter, the system worked like this:

Engineers selected from their home groups for the *Crusader* project followed their assigned systems and subassemblies from preliminary design to flight test. Teamed with engineers from other groups, they gave mutual assistance and enlarged their own view of the program.

At the same time, liaison was maintained with the home groups on methods, research and policy. This way, the state of the art was coordinated with the practical problems of project work. Engineers of one specialty, working with those of another, reached better compromises, developed a wider view.

Whether you are an experienced project man, a technical specialist, or a junior engineer, you, too, will appreciate project-group advantages.

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40th ANNIVERSARY
1917 TO 1957

AERIAL VIEW of Amon Carter Field. Instrument runway (13-31) is being extended to 8,450 ft. Both runways are now 6,400 ft.

Ft. Worth Prepares Airport for Jet Era

By Craig Lewis

Ft. Worth—Amon Carter Field is currently undergoing a $750,000 runway expansion program which is one of the final touches needed to prepare the airport for airline jet operations.

Current expansion is expected to give Carter Field all the runway it will need for turbine operations and keep it prepared for its role as a centrally located airport in a rapidly expanding metropolitan complex that includes both Dallas and Ft. Worth.

Often the center of perennial controversy between Dallas and Ft. Worth, Amon Carter Field—officially Greater Ft. Worth International Airport—is now operating at a profit and handling a growing amount of traffic as it waits for its air travel market area to grow up to its modern, expansive facilities.

Airport History

Amon Carter Field was hatched as an idea and as a focal point for recurrent Ft. Worth-Dallas squabbles in 1940 when an airport midway between the two cities was discussed at hearings of a state airport commission. The cities didn't like the idea of a joint project then, and their disagreement prevails now.

When it became evident that Dallas and Ft. Worth wouldn't agree to build a midway airport, the airlines decided to take action. Attracted by the economies of operating from a single airport, American Airlines and Braniff Airways (later joined by Delta Airlines) formed the Midway Airport Corp., promoted a site exactly midway between the two cities and got nearby Arlington to sponsor the field in order to make it eligible for Federal aid.

With the help of the Civil Aeronautics Administration, U.S. Army Corps of Engineers built the airport in 1942. During World War II it was used mainly by North American Aviation and by American Airlines for military pilot training contract work.

After the war it was apparent from the history of disagreement, and the continuing rivalry between the cities, that the midway airport wasn't going to attract joint development by Dallas and Ft. Worth.

Dallas Adamant

Dallas committed itself in 1945 to a master plan for development of its own Love Field, arguing mainly that Dallas citizens shouldn't have to travel 18 mi. to the midway airport when Love Field is only five miles from downtown. Completion of the new Dallas terminal this month is current evidence of the city's decision to stick with Love Field.

With joint use out of the question, the airport corporation set out to sell Ft. Worth the idea of building a new airport at the midway site instead of on a site selected south of the city.

Ft. Worth bought the idea. Dallas then asked CAA for a hearing on the airport location on the grounds that it was too close to the market served by Love Field. CAA refused to stop construction, and the courts backed up the decision.

Arlington deeded the airport to Ft. Worth, more land was acquired, and construction of completely new facilities began late in 1949. American, Braniff and Delta got 36-year leases on property adjacent to the terminal, but American's $1.5 million hangar is the only structure on the leased land so far.

Airport Financing

The airport cost $11.5 million, $5 million of it in federal aid matching funds. Ft. Worth's share was paid out of a general obligation bond issue. The field was opened in April, 1953.

Management of Carter Field was turned over to Ft. Worth Air Terminal, Inc., on a 36-year operating lease. The terminal corporation was formed by 23 Ft. Worth businessmen who capitalized it at $500,000. The group also borrowed $750,000 and gave it to the city as prepaid rent.

Last attempt to get Dallas and Ft. Worth together on the midway airport was a federally-inspired offer to share the field after it was finished. Ft. Worth offered Dallas half of the airport for about $2 million, but Dallas declined.

Carter Field's terminal contains 242,000 sq. ft. of floor space and is designed for vertical separation of passenger work areas. Passengers enter at the airline ticket counters in the south wing and drop their baggage, then proceed through a spacious lobby area to one

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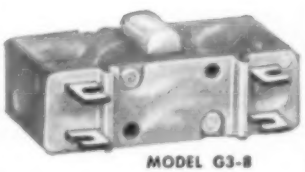
Subminiature sealed switch is environment-free; mounts interchangeably with MS25085

MODEL EF-3

Single Pole, Double Throw
Move. Differential, .004 Max.
Overtravel, .003 Min.
Oper. Force, 5 to 17 oz.
Release Force, 60 gram
Elec. Life Ratings:
150,000 ops. @ 125/250 V. A.C., 2.5 AMP.
100,000 ops. @ 125/250 V. A.C., 5.0 AMP.
50,000 ops. @ 30 V. D.C., (2.5 AMP., IND.; 4.0 AMP., RES.)
Amb. Temp., −65° to +180° F.

Sealed in a corrosion-resistant, treated aluminum enclosure, this tiny switch is environment-free; highly vibration and shock resistant. It carries 5 amps. at 125/250 V.A.C. with an electrical life rating of 100,000 operations. Low operating force and small movement differential make it ideal for bi-metal temperature, diaphragm operated and other "feather-touch" devices, while small size permits mounting singly or ganged in restricted space. Rugged and dependable, it has positive snap action.

Tiny 40 amp. basic switch has high capacity, longer life and constant stability of tolerances



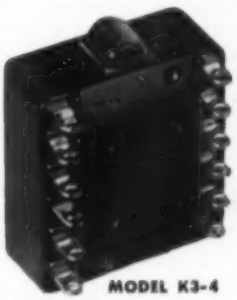
MODEL G3-8

Measuring only 1¾" x 43/64" x 35/64", the Electro-Snap G3-8 Basic Switch handles current ratings up to 40 amps. A new method of combining Electro-Snap's double-break action with a heavy-duty switching element assures electrical and mechanical life of 100,000 cycles at large capacities; also provides constant stability of tolerances and accurate repeatability. New plastic compound case gives the switch an ambient temperature rating of —100° to +300° F. with extreme shock resistance. Small size makes it ideal for motor controls and compact automation set-ups. A wide range of actuators is available.

OPERATING CHARACTERISTICS

Single Pole, Double Throw
40 AMPS @ 125/250 V. A.C.
@ 30 V. D.C. Res.
Oper. Force, 45 oz. Approx.
Overtravel, .015" Min.
Move. Differ., .055 ± .010

Simultaneous triple-pole switch interrupts 3-phase ac. circuits; 6-circuit control in a small package



MODEL K3-4

Triple-Pole, Double Throw
15 AMP., 125/250 V. A.C.
30 V., D.C. Res.
10 AMP., 30 V., D.C., Ind.
Overtravel, .015 Min.
Move. Diff., .028 ± .007
Mech. Life, 1,000,000 ops.
Elec. Life, 500,000 ops.

This Electro-Snap triple-pole switch simultaneously reverses current flow through three windings of a 3-phase motor up to 1 H.P. and interrupts other types of multi-switching installations. Instantaneous "make" and "break" snap-action of the three poles is independent of the speed of actuation—even extremely slow moving cams can be used.

The K3-4 Series offers designers a wide variety of 3-phase circuit hookups for servo-controls, to limit movement of machine members and as a start-and-stop switch which formerly were possible only with complicated relays or a number of separate switches. A large selection of standard actuators is available.

Small basic switch is low cost; directly interchangeable with AN3234 Specs

F2 SERIES

These Electro-Snap F2 Series snap action switches are extra-compact with extremely high electrical capacity for their size. Mechanical and electrical life at 1/32" overtravel is 150,000 operations, minimum, with accurate repeatability and constant stability of tolerances. Self-aligning springs provide contact wiping action rare in a switch of this size.

Durable case of special plastic gives the switch an ambient temperature rating of −100° to +275° F. or +375° F. Available, *at low cost*, in three basic models with a wide selection of actuators.

SERIES F2 BASIC SWITCH: F2-3: Single Pole, Double Throw
F2-2: Single Pole, Normally Open; F2-1: Single Pole, Normally Closed

OPERATING CHARACTERISTICS

Electrical Rating: 10 AMP. 125/250 V. A.C. 60 cycles
30 V.D.C. inductive and resistive (6 AMP. 30 V.D.C. for Airborne Application)
Operating Force, 7 to 12 oz.
Reset Force, 4 oz. Min.
Pretravel, 3/64 Max.
Movement Differential, .011 ± .005
Overtravel, 1/32 Min.

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- ☐ K3 — Triple-pole
- ☐ F2 — Extra-small basic

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of two fingers containing enough gates to handle 17 DC-7-type aircraft.

Escalators Reversible

In the finger, the passenger descends via escalator to the loading gate. Escalators are reversible to handle incoming flights. Lower level of the finger contains gates, airlines' operation offices, passenger rest rooms.

Terminal is air conditioned, except in the passenger areas of the fingers where extensive use of glass makes the cooling job too expensive.

Lower level of the terminal building contains baggage handling facilities, cargo docks, air mail room, kitchens, utility room. Out of the utility room run tunnels under each finger, carrying utility and communications lines.

Ramp area is designed to eliminate as much traffic as possible. Fuel and air conditioning trucks are replaced by underground systems. Transports are cooled on the ground through a collapsible hose attached to a cool air source built into the ramp. System pumps 60 deg. air into aircraft, keeping inside temperature at 72 deg. while the planes sit in the hot Texas sun.

Underground hydrant refueling system is a pioneer operation and the first really successful underground system in the country, according to Maury Huffman, executive director of the terminal corporation. The system stores 300,000 gal. of fuel and can pump 1,000 gal. a minute at each gate. It is designed for under-wing and one-point refueling.

Each gate has eight spare ducts running underground from the utility tunnel to its parking ramp in anticipation of any future needs the airlines might have for hydraulic or communication lines.

On the opposite side of the terminal from the ramp area is a heliport which divides a 1,100 car parking lot. The heliport has a 42-ft. triangular landing pad. It was placed opposite the ramp area so it can be easily controlled from the tower, but won't interfere with fixed wing operations. Civil Aeronautics Board has never issued a certificate for scheduled helicopter service in the area, so current use is confined to air taxi operations.

Runway Lighting

Amon Carter Field currently has two 6,400-ft runways. Instrument runway is equipped with a centerline approach light system over 3,000 ft. long and with

Local Service Purchases

Washington—Local service airlines are now in a position to purchase approximately 200 modern transport aircraft as a result of the $140 million credit which will be available to them through the new Civil Aeronautics Board loan guaranty law.

A total of 28 companies are eligible for 90% guaranty of private loans up to $5 million each under the new law. The eligible group includes 13 local service carriers in the U. S., 12 airlines in U. S. territories and three helicopter airlines. At present, these airlines are operating 309 transport planes including 233 DC-3s and 22 helicopters.

Here is a list of the carriers with number and types of aircraft on hand and those on order:

TRANSPORT-TYPE AIRCRAFT

CARRIER	Douglas DC Series	Other	Total on Hand	On Order or Option	Misc. Small Aircraft
13 LOCAL SERVICE					
Allegheny Airlines	15	6 Martin-202	21		
Bonanza Airlines	9		9	6 F-27	
Central Airlines	12		12		
Frontier Airlines	14		14	6 "	
Lake Central Airlines	10		10		
Mohawk Airlines	11	11 Convair	22		
North Central Airlines	23		23		
Ozark Airlines	20		20		
Piedmont Airlines	20		20	24 "	
Southern Airways	13		13		
Southwest Airways	10	7 Martin 202 1 Lockheed 12A	28	3 "	
Trans-Texas Airways	20		20		
West Coast Airlines	14		14	6 "	
Sub Total	191	25	216	45 F-27	
8 ALASKAN					
Alaska Airlines	7	3 C-46	10		
Alaska Coastal Airlines	..	.....	...		17
Cordova Airlines	2	2 C-46	4		7
Ellis Air Lines	....		...		13
Northern Consolidated Airlines	4		4	3 "	12
Pacific Northern Airlines	8	3 Lockheed 649	11		..
Reeve Aleutian Airways	3		3		3
Wien Alaska Airlines	3	4 C-46	7	3 "	15
Sub Total	27	12	39	6 F-27	67
2 HAWAIIAN					
Hawaiian Airlines	8	5 Convair	13		
Trans-Pacific Airlines	8		8		
Sub Total	16	5	21		
2 CARIBBEAN					
Caribbean-Atlantic Airlines	4		4		
Mackey Airlines	7		7	2 "	2
Sub Total	11		11	2 F-27	2
TOTAL	244	42	287	53 F-27	69

HELICOPTERS ON HAND

	Bell	Sikorsky	On Order or Option
HELICOPTER AIRWAYS			
Chicago Helicopter Airways	6 47-G	3 S-55	3 S-58
Los Angeles Airways		5 S-55	2 S-51
New York Airways	1 47-H	5 S-55	4S-58
TOTAL	7	13	2 7 S-58

high intensity runway lights. Other runway has medium intensity lights.

Huffman told AVIATION WEEK that Ft. Worth is trying to obtain condenser discharge lights for the approach system at Carter Field as a service for aircraft operating in the general area, as well as for those flying into the Ft. Worth Airport. Carter Field is presently equipped with transmissometer, ceilometer and ILS, and has a surveillance radar which covers other airports in the immediate vicinity.

In the present construction program, the instrument runway is being lengthened from 6,400 ft. to 8,450 ft. This length is judged sufficient to handle a transport of the Boeing 707 type with full load.

Land for Expansion

If airline turbine operations should require it in the future, Carter Field has enough land on its 1,878 acre site to stretch the instrument runway to 12,000 ft., a project that would carry it over an adjacent highway and require an underpass for highway traffic. Airport is also considered large enough to accommodate a parallel instrument runway 1,800 ft. from the present runway.

Airport authorities are currently buying land to provide clear zones 1,000 ft. wide and a mile long at each end of both runways. Approaches are protected from obstructions within a five-mile radius by zoning regulations.

Expansion of the terminal is also possible when traffic warrants it. Lobby and restaurant can be doubled in size, present 208 ft. of ticket counters can be doubled, and space has been reserved for two more gate fingers which will handle another 15 aircraft.

Old bitterness in the rivalry between Dallas and Ft. Worth has diminished perceptively in recent years, and forecasters envision the two cities as part of a single metropolitan complex within the next 10-20 years. This concept is spurred by continuing industrial development of the area between them.

Future Is Promising

Huffman points out that when this day comes, Amon Carter Field will be in the center of a metropolitan area with a 2-3 million population. He also observes that at that time the airport will have clear approaches and buffer zones, and it will be concerned only with airline operations since no attempt is made to encourage private or business aircraft traffic to use the field.

Better communications will also aid the growth of traffic at Carter Field. Recent opening of a Dallas-Ft. Worth turnpike greatly improves travel time between the airport and both cities, and this routing will be improved even more within the next eight months when a direct access road is completed

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between the turnpike and the terminal.

Right now, Carter Field is operating at less than full capacity, although traffic has been growing. Passenger traffic increased 46% between the first half of 1954 and the first six months of this year. In the same period, airline schedules increased 55% and aircraft operations increased 98%.

Carter Field has operated at a profit since December, 1955, and current profits are running $8-10,000 a month. Profits are applied against the terminal corporation's $750,000 loan, which will be retired in 1962. After the loan is paid off, profits are to be split between the corporation and Ft. Worth.

Self-Contained Shelf Designed for Jetliner

New integrated electronic rack and shelf system will be installed below deck in the Convair 880 jet transport. Designed by Robinson Aviation, Inc.'s, West Coast engineering office, Santa Monica, Calif., the equipment features a shock and vibration isolation arrangement with Met-L-Flex resilient elements. As installed in the Convair 880, the shelf system will support a total equipment weight of about 500 lb.

Each shelf, incorporating its own wiring and junction box with quick disconnects, can be removed in less than a minute for replacement or repair services. Between the vertical cooling duct and shelf plenum chamber there is a slide-fit junction to speed removal.

If weight or center of gravity of individual pieces of equipment is changed, there is a minimum effect on the overall supported mass, hence there is no need for changing load ranges on the shock mount system.

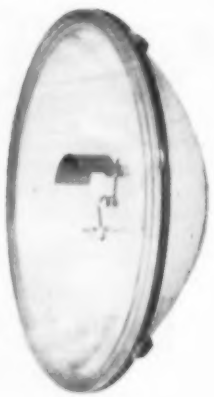
Length of the Convair installation is 43 in., height 30 in., depth 23 in.

Same approach, devised by Robinson, is used in North American Aviation's new utility transport/crew readiness trainer Sabreliner jet, which uses a single integrated shelf installation.

Boeing also is interested in the integrated electronic rack and shelf system for its 707 jet transport.

. . . from fractional amps

to landing lamps . . .



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Los Angeles Initiates Runway Construction

Marking the first major construction step in a planned multimillion dollar expansion of Los Angeles International Airport, the Board of Airport Commissioners has called for bids for construction of a new takeoff runway and taxiway system.

Known as Complex I, the project will cost more than $2 million, will include an 8,925 ft. runway and necessary taxiways. Groundbreaking is slated for the last week in November. New runway will speed operations at the airport by permitting simultaneous landings and takeoffs in conjunction with present dual runways.

Unprepared for Jets, CAB Official Warns

Sun Valley, Idaho—John W. Dregge, Civil Aeronautics Board routes division chief, warned the aviation industry that it is too complacent toward problems posed by the approaching jet age. This complacency, he said, is not only frightening, it approaches the tragic.

Speaking at a meeting of the National Assn. of State Aviation Officials, Dregge said: "We must face up to the fact that at the present time we are not prepared for the problems it presents, and time is running out on us."

The CAB official pointed out that in a little more than a year deliveries of jet aircraft to airlines will begin. In two years, he said, there will be about 188 jets in operation over domestic routes, and, by 1960, there will be a total of 279 turbine engine transports in operation.

"But," he asked, "what have we done to prepare for this revolution in air transport, a revolution as pronounced as when we stepped from the Model T

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New Aeroproducts air-driven generator supplies emergency power in Douglas A3D and A4D

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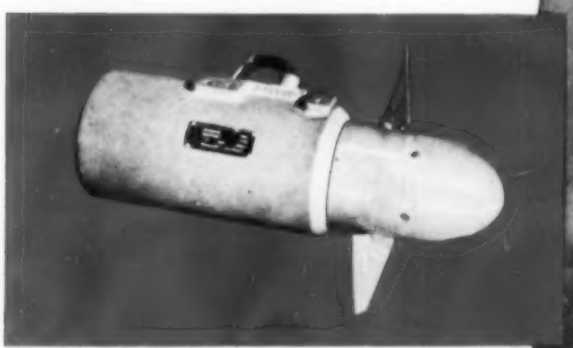
The same engineering know-how which has made Aeroproducts the leading designer and producer of turbo-propellers is available to assist you with the design, development and production of ram air-driven generators and hydraulic pumps, actuators and other air-borne accessories.



Using a simple blade pitch-changing mechanism, this Aeroproducts ram air-driven emergency generator gets up to speed in less than 1/10th second—governs its output frequency between plus 10% and minus 5% over a wide range of air speed, altitude and load conditions.

For detailed information on how Aeroproducts can assist you with your aircraft accessory designs, write on your company letterhead for 28-page brochure, "Actuators for Aircraft" and new design catalog, "Aeroproducts Ram Air Accessories."

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The installation of PACITRON on the Convair 880 is continuing proof of Simmonds' leadership as "first in electronic fuel gaging."

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age to the high compression, modern automobile of today."

Dregge said experts already are working on technical problems such as air traffic control, navigational aids and operational problems but that his primary concern is with the economic aspects of air transportation in the jet age.

The handling of passengers and their baggage, the adequacy of airport terminal facilities and the effect of jets upon the air service pattern and intermediate, local and feeder carriers are some of the problems he outlined as needing immediate attention.

The scheduled airlines' capacity of 59,000 seats in 1956 will be increased by about 100% by 1960, Dregge said. He added that it is the responsibility of everyone in the industry to develop new thinking and planning to meet the challenge and fill these additional seats. He asked:

"How many of our airports today are capable of handling these jet aircraft carrying 120 to 150 passengers from the passenger service point of view?"

"In our already congested terminal buildings, how many airline ticket counters could check in one planeload of 150 passengers, not to mention the problem of loading 150 passengers at the ramp?

"Baggage handling today is one of the most disturbing problems in the air transport industry. What are we going to do when a jet aircraft dumps the baggage of one or more planes carrying 150 passengers each into our already inadequate baggage handling facilities? How many airports today can adequately handle the surface transportation problems from the airport to the city?"

He also said it is safe to assume that jet aircraft probably will have a minimum stage length of at least 500 miles in which they can operate efficiently, resulting in changing service patterns.

"This will mean that many of our important traffic generating points that are located near another major traffic generating point may not receive jet service," he said. "More importance will be attached to the feeder type of air service either by our intermediate carriers or by our local service carriers."

The CAB routes division chief also predicted a greater need for the intermediate and feeder type of service than is in existence today.

"I cannot help but feel," he said, "that the local service industry within the next 10-year period will really come into its own. They are today serving a most important segment of our air transport requirements. I firmly believe that this importance will become increasingly greater and that their feeding traffic into the major trunklines for the longhaul service will be an ever more vital part of our air service pattern."

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When you want to investigate the possibility of bringing your Calidyne Vibration Test System up to date, get in touch with us here at Calidyne — we can quickly tell you what can be done. The telephone number is Winchester (Boston) 6-3810, or write:

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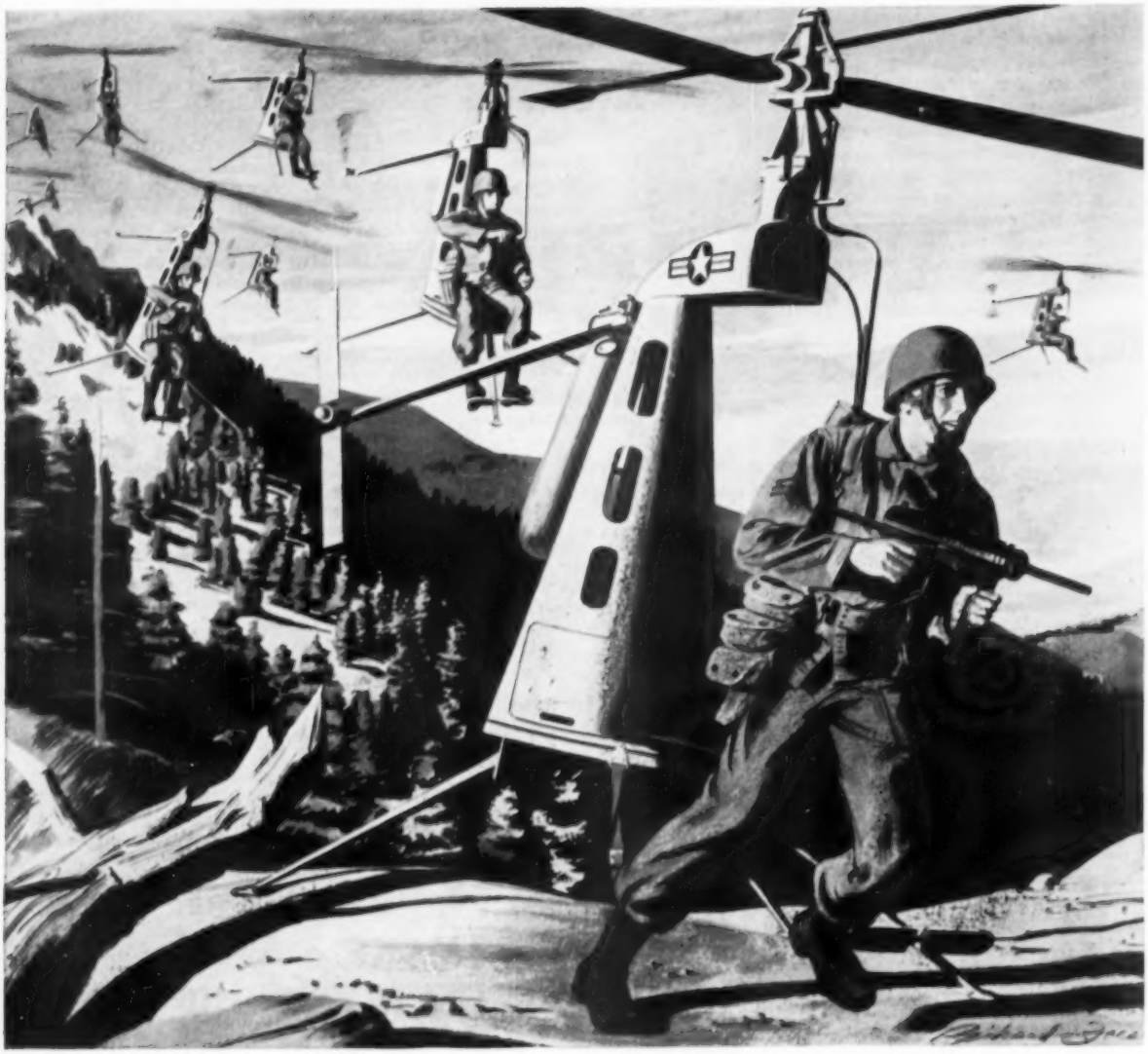

World's smallest gas turbines to lift a sky full of men

MAXIMUM AERIAL MOBILITY is an important aim of America's military forces. Solar advanced technology is helping to realize this goal by designing the smallest gas turbine aircraft engine ever built. The 55 hp Titan engine, weighing only 50 pounds, will power one-man helicopters like those pictured in this artist's conception, as well as flying platforms. It represents an important addition to Solar's growing family of gas turbine engines.

For over a decade Solar has been a world leader in the design, development and production of small-size gas turbines. Current production models—the 50 hp Mars® and 500 hp Jupiter®—are being turned out in volume for a wide range of military and commercial applications. Uses include portable power generation for industry, aircraft ground support, boat propulsion and others.

Compact and lightweight, simple in design, Solar gas turbines offer many advantages over conventional power plants. They start instantly in severe temperature extremes, require a minimum of maintenance and can be operated on a variety of fuels. Perhaps one of these versatile engines can solve your power problems. Write today for a new gas turbine brochure. Dept. D-105, Solar Aircraft Company, San Diego 12, Calif. *Designers, developers and manufacturers of gas turbines, expansion joints and aircraft engine, airframe and missile components.*

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ENGINEERS WANTED. *Unlimited opportunities, challenging projects, good living with Solar! Send for new brochure.*

Lufthansa Grosses $19 Million in 1956

Bonn, Germany—Lufthansa-German Airlines grossed $19.18 million with a net loss of $4.77 million during 1956, its first full year of post-war operation, according to the airline's annual report. Deficit for 1955 was $5 million. Losses are government subsidized.

Operating expenses for 1956 were $23.95 million. The airline carried 229,670 passengers, up threefold from 1955, with a passenger load factor of 52%.

Lufthansa also tripled its route miles in 1956 to a total of 28,000. Big expansion during the year included inauguration of service to North and South America, Africa and Asia. Next year the carrier plans to add Rome to its European network, and in 1958-59 to add Oslo, Stockholm, Helsinki, Barcelona and Amsterdam. In 1959, plans call for extension of Near East service to Cairo, and in 1960 Lufthansa expects to begin daily service to Karachi on a Far East route that will eventually include India, Bangkok, Singapore, Manila, Hong Kong and Tokyo.

To date, the carrier's route miles total 37,500. Fleet now comprises eight Lockheed Super G Constellations, five Convair 440s, four Convair 340s and three DC-3s. Delivery of first of four 1649A Constellations has been taken, and the airline has four Boeing 707s and nine Viscount 814Ds on order.

California Legislates On Aviation Measures

The California Legislature has taken a number of actions affecting the aviation industry, including the following:

- **Voted $87,079** for the support of the California Aeronautics Commission for the fiscal year beginning July 1st, an increase of 66% in the commission's expenditure program. Included is $16,650 for the purchase of a new airplane to replace one lost in a crash in 1953.
- **Boosted to $25** a day the pay for commission members, plus expenses, while attending meetings.
- **Approved legislation** authorizing cities to sell or lease for a term of not exceeding 20 years with an option to purchase, any municipal airport or any property owned for airport purposes or purposes incidental to aircraft.
- **Amended various** sections of the Public Utilities Code affecting air space and issuance of airport permits.

The changes were designed to guarantee the airports protection. As an example, one is intended to give the aeronautics commission power to take

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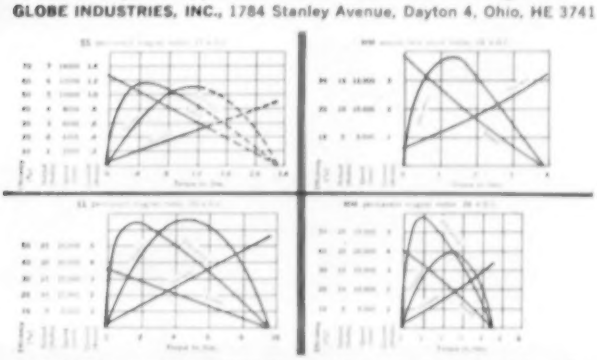

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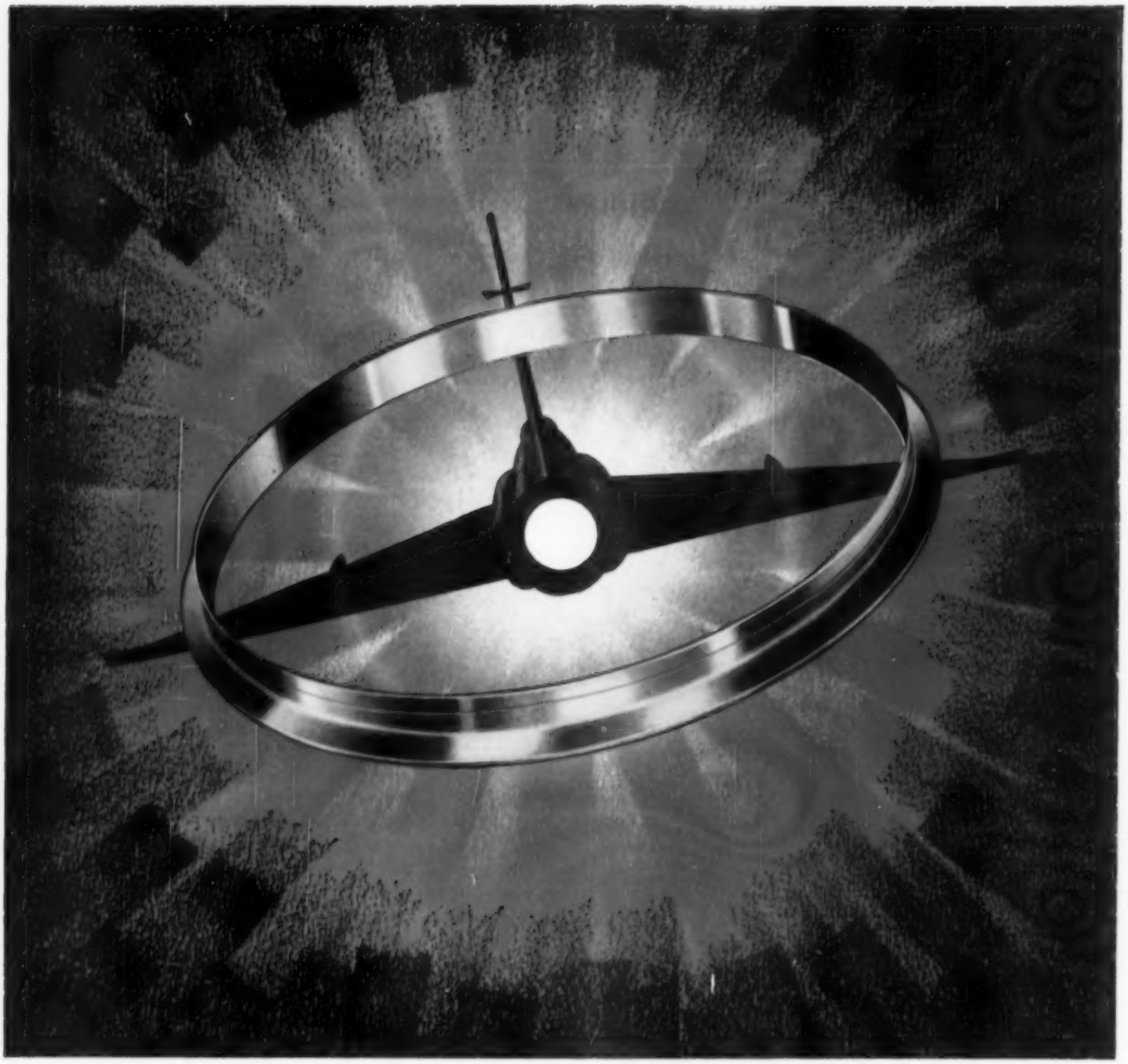

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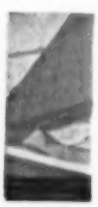

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action if adjacent landowners suddenly erect structures interfering with the operation of an airport.

Another piece of legislation passed requires the State Department of Education to aid and assist local school districts in the development and conduct of a program of aviation education. The bill authorizes the Aeronautics Commission to aid in the selection of airports and pilots used by local school districts in flight indoctrination and instruction. The commission also is authorized to make available to public schools offering actual flight experience a basic insurance program and to assure that adequate supervision and precautionary measures are taken by the flight school operators contracted to provide services for public school students. The measure provides for aviation experiences in junior high schools in the areas of social studies, science and arithmetic and actual flight experience in the high schools where appropriate airports, planes and pilots are available.

The State Senate approved the creation of an interim committee of three members with an appropriation of $7,500 to study aviation problems.

The resolution creating the committee points out:

"The aviation industry, as a whole, is now the largest single industry within the State of California.

"It is vital to the economy of the state that the legislature be fully informed as to all facts relating to aviation and the aviation industry and all problems connected therewith, in order that legislation affecting said industry can be intelligently considered by legislators having special knowledge concerning said industry."

The committee is authorized and directed to "ascertain, study and analyze all facts relating to the subjects expressed in the recitals of this resolution including, but not limited to, facts relating to aircraft manufacturing, civil air transportation by scheduled and unscheduled air carriers, fixed base operators and executive and private aircraft operations; civil and military airports whether publicly or privately owned; agricultural aviation including crop dusting and aviation used in forest management and livestock and wildlife management; the use of aviation in civil defense, foreign and domestic commerce and as a tool of government; aviation education in the public schools and by other means and the California Aeronautics Commission."

The legislature rejected a proposal to give public agencies immediate possession of land to be condemned for airports. The lawmakers also turned down proposals to enact an aircraft financial responsibility law and to raise money for public airport maintenance and construction.

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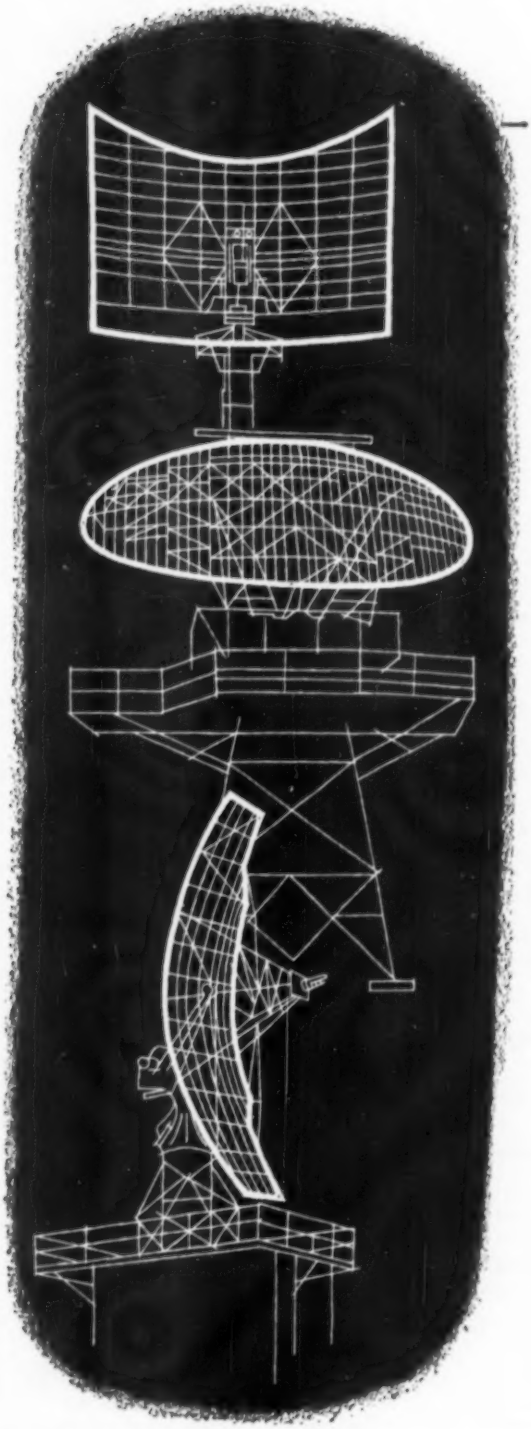

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FS-6005, Aviation Week,

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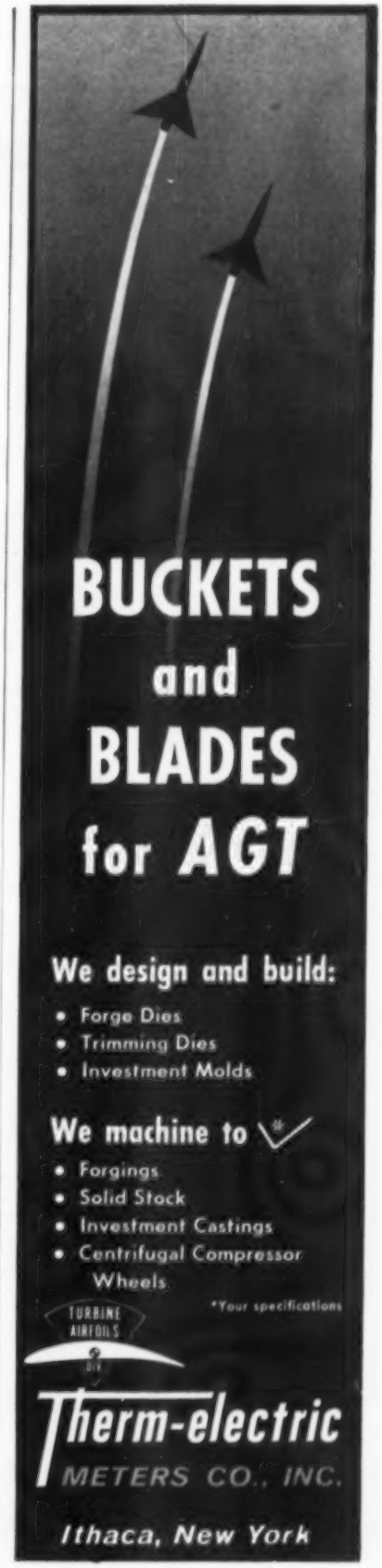

LETTERS

Question of Size

I wish to take this opportunity to congratulate you on your fine magazine. I have been an ardent reader of AW for some time.

In reference to your article on the A4D Skyhawk in your Aug. 26 issue, p. 50 (second paragraph), that the A4D is the smallest and lightest of U.S. jet planes. I do not wish to take issue with you on this item, because I am no authority on it, but I have been under the impression that the Lockheed F-104 is actually the smallest and lightest U. S. operational jet plane. This is based on figures I have read on both planes. They may or may not be correct. However, I submit them to you.

	A4D	F-104
Wing Span	27.5 ft.	22 ft.
Gross Weight	15,000 lb.	13-14,000 lb.
Height	15 ft.	13 ft. 6 in.
Length	39.4 ft.	54 ft.

You will notice that the only dimension where the Starfighter is greater is in length. This may alter one's terminology of it being larger or smaller in the overall picture. I do not think so.

I also understand the F-104 is still the fastest airplane in the skies today, surpassing all other aircraft we may have and even the highly touted English Electric P.1.

R. D. Carson, Jr.
Peerless Machine & Tool Co., Inc.
Marion, Ind.

Army Plans Defended

The El Paso Chapter of the Association of the United States Army is primarily a civilian group heavily concerned with the Army because of the proximity of Ft. Bliss, but even more concerned with the general welfare of the nation. As such, we comment on your editorials, "Who Really Develops Missiles?" (Sept. 23), and "Perspective on Missiles" (Sept. 30).

Public interest in the missile program has suddenly been stimulated by the USSR's satellite and by the possibility of revised policies in the Department of Defense. We believe that public opinion influences these policies and our security. We believe that statements made by a professional and technically responsible publication such as Aviation Week should be factual and constructive.

Before accusing any branch of the service of technical naiveté or waste of missile funds, we should compare the defense output per dollar of each branch.

In your Sept. 30 editorial you state that, "The billions the Army has poured into land, concrete and missiles for its Nike Ajax system, designed at the very best to stop piston-engined bombers over short ranges, is a classic example of military waste through stupid planning."

This statement could be made only through extreme prejudice coupled with complete ignorance of the Nike system, which was *planned* as an open-ended system capable of including a missile component of increasing and unlimited performance characteristics. The Nike system has the great economic advantage of minimum airborne guidance. Guidance, unlimited by missile environmental and packaging problems, and capable of unlimited re-use, is ground based. By substitution of the Hercules or Zeus airframe for the Ajax, the system is converted from better than "piston-engined bomber" defense to missile defense.

The success of this system has resulted from the Army's freedom from fixation of manned aircraft configuration, propulsion, guidance and control, and from resultant high cost of systems of limited application and rapid obsolescence. You may call this technical naiveté, but not stupid planning.

We are thankful that you agree that ". . . real progress in the development of missiles or any other highly technical weapon system depends on the efforts of many research agencies and industrial teams, and no single agency or technical group has a monopoly on development capability in any field of science."

Likewise, the defense of this country depends on the efforts of many and is not the exclusive privilege of any one service. The Army, Navy and Air Force each has its place. We take pride in the progress of each service, but can only feel revulsion for those responsible when one service attempts it at the expense of another.

Hervey W. Dietrich, M. D.
President, El Paso Chapter
Association of The United States Army

(Cost of modifying Nike Ajax sites to accommodate Nike Hercules missiles is estimated by Defense Department sources at about $250,000 per site. No detailed estimates are available for conversion of Hercules sites to Nike Zeus but it will be considerably more than the Hercules costs.—Ed.)

Report Appreciated

The story on the Navy Heller Report in the Sept. 30 issue (p. 34) is most interesting and encouraging. As a member of Aeronautical Training Society and one who is engaged in training work for the United States Air Force, I believe a real service has been rendered in release of this report.

I understand that some persons in the Navy are attempting to make something sinister out of the civilian contractors' interest in Navy contract training. Aside from our business interest in contract training, we have a deep interest in what the Navy does as tax payers. In opposing the recommendations in the Heller Report, as the Navy is doing, one could ask, "Is Navy putting Navy ahead of country?"

Another thing that seems apparent is that the Navy primary flying time has been drastically reduced, and I wonder if the savings would not be even greater if the primary training periods were similar to that of the Air Force. In the Air Force primary students receive 130 hr. of flying training during the first six months.

Beverly Howard, President
Hawthorne School of Aeronautics
Moultrie, Ga.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Columbus Apologist

I imagine that about the same time that I was reading H. L. Moxham's letter (AW Sept. 2, p. 118), with quite a bit of disbelief that such a missive could have been submitted by him, quite a few of the executives of our Columbus Division were receiving the same sort of shock. Loyalty and pride toward one's company's product is one thing, an admirable quality, but to slander one's competitor who also produces excellent competition is unforgivable by those at home whom he belittles by association. This apology, if you like, is not in behalf of our company, but in behalf of the clearer thinking engineers here at Columbus who believe in professional ethics and genuine competition.

Embarrassed Engineer
Columbus, Ohio

Spell It Out

The growing frequency of abbreviations in Aviation Week articles is beginning to detract from my reading efficiency.

Aviation Week readers (AWR) are responsible engineers and are members of accepted engineering societies (MAES) who are familiar with documents like Armed Services Technical Information Agency (ASTIA), organizations like United States Air Force (USAF), and many of the special identifying notations (SIN) used by organizations in our industry like the National Advisory Committee for Aeronautics (NACA). However, many useless, referred to only periodically, symbols (URPS) like NMIC slip from our memory because they are URPS.

Articles on international subjects (AIS) and special articles on civil aviation (SACA) use URPS in some of your RI. Examples of URPS in your RI on AIS and SACA make references to AGARD, VORTAC, NOTAM and similarly abbreviated organizations and objects.

I would like to make a special suggestion. My SS is that URPS be presented so that AWR who are MAES be considered when you use SIN so that AIS and SACA are more clearly presented.

Perhaps other AWR comments on URPS relative to AIS and SACA in FI might help. So PHFUT* against abbreviations. I repeat, PHFUTAA!

C. R. Englebry
Special Aerodynamics Unit
Lockheed Aircraft Corp.
Burbank, Calif.

* Please help foster a united trend.
(Will try!—Ed.)

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